

# Self-perception of driving abilities in older age: A systematic review



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## ABSTRACT

Older adults have become the fastest growing age group worldwide and will continue to make up a more significant portion of the driving population. Given the increased potential for age-related perceptual, cognitive, and physical declines, it is important to understand the perception that older drivers have regarding their own driving abilities. This awareness often motivates their driving behavior and patterns.

A systematic review was conducted to synthesize the literature regarding the self-perception of driving abilities in older age. The PRISMA method was used and 10 databases (SCOPUS, TRID, PsycINFO, AgeLine, Web of Science, Abstracts in Social Gerontology, Inspec, Compendex, PubMed, and Medline) were searched to identify relevant articles. A total of 25 articles met the search criteria and were included in the qualitative synthesis.

Overall, methods used to assess self-perception of driving abilities in older adults vary considerably. Some studies employ only subjective questionnaires, while others administer questionnaires in addition to on-road driving or simulated evaluations. Nonetheless, the studies overwhelmingly report that older drivers tend to rate highly, and often overestimate, their driving abilities. They perceive their driving abilities to be better than themselves at a younger age, their cohorts, and all other drivers. However, more work is needed to develop improved subjective assessments that guide drivers in more accurately estimating their true driving abilities, as well as to compare subjective ratings to objective performance-based measures of driving abilities.

This review may assist researchers in better understanding the characteristics that influence driving self-perception and may inform the development of interventional strategies that help older drivers to better calibrate how they perceive their driving.

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## 1. Introduction

The number of adults aged 65 years and older is rapidly growing, and this worldwide trend is projected to continue over the next several decades (Czaja, Boot, Charness, & Rogers, 2019; Erber, 2012). In the United States, the percentage of older adults in the total population will increase from 16% in 2019 to an estimated 27% by the year 2050 (U.S. Census Bureau, 2018, 2020). Similar growth is also expected to be observed in the driving population. Particularly, in 2011, the percentage of older drivers was also 16% and by 2025, one in five drivers (20%) will be at least 65 years of age (Federal Highway Administration, 2018; McElligott, 2015).

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Mobility enhances quality of life by enabling independence and reducing the chance of health-related issues brought on by depression or social isolation (Liddle, McKenna, & Broome, 2014; Molnar, Eby, St Louis, & Neumeyer, 2007; Ragland, Satariano, & MacLeod, 2005). However, a number of age-related changes may make driving, or certain parts of driving, difficult for older drivers. For example, perceptual challenges, such as, reductions in visual acuity and the useful field-of-view (Ball, Beard, Roenker, Miller, & Griggs, 1988), and diminished ability to discern multiple auditory streams (He, Dubno, & Mills, 1998); cognitive challenges, e.g., declines in executive function (Bryan & Luszcz, 2000) and difficulties with attention management (Choi, Grünh, & Feng, 2015) and memory (Anstey, Wood, Lord, & Walker, 2005; Guerrier, Manivannan, & Nair, 1999); and physical challenges, e.g., diminished muscle strength and movement precision (Anstey et al., 2005; Buchman et al., 2009; Fasano, Plotnik, Bove, & Berardelli, 2012; Kluger et al., 1997), may all inhibit the successful control of a vehicle. These documented issues are one of the many reasons that older adults are one age group among all drivers with, on average, higher traffic crash rates (Langford & Koppel, 2006).

As people age, some can recognize and identify these sensory, cognitive, and physical changes by themselves, while others cannot. In the latter case, older adults who do not notice age-associated changes often benefit from individuals closest to them relaying this information (Söllner & Florack, 2019). However, those who are able to assess their own changes may, by their own volition, moderate certain daily behaviors so that these behaviors become more aligned with their capabilities, limitations, and preferences, i.e., implement self-regulatory practices (Ang et al., 2019; Baldock, Mathias, McLean, & Berndt, 2006; Blanchard & Myers, 2010; Charlton et al., 2006; Eby et al., 2015; Molnar & Eby, 2008; Molnar et al., 2015, 2018; West et al., 2003). Specifically, with respect to driving, research has found that older adults often reduce annual driving mileage (e.g., Molnar et al., 2015), avoid certain driving situations, e.g., driving at nighttime, in high traffic, in bad weather, or through intersections (e.g., Molnar et al., 2018), and/or drive at lower speeds and with larger headway distances (e.g., Andrews & Westerman, 2012; Charlton et al., 2006). While this knowledge is valuable for understanding the decisions that drivers make regarding their practices, many of these studies focus solely on older adults' driving self-regulated behaviors without examining the underlying motivations of the self-regulation (Eby, Molnar, & St Louis, 2018). However, Eby et al. (2018) suggest that age-related self-regulation, in terms of both driving avoidance and reduction, is linked to the perception of one's own driving abilities. In fact, previous studies have found self-perceived driving ability to be a better predictor of self-regulation than actual driving abilities (e.g., Blanchard & Myers, 2010; MacDonald, Myers, & Blanchard, 2008).

Self-perception of driving abilities is the subjective opinion or impression that one has about his/her own driving abilities. If older drivers possess the right awareness of their abilities, then they may correctly modulate their behavior. However, those who have inaccurate representations of their age-related changes may under- or overestimate their driving abilities, which can bring about negative consequences. For instance, if older adults perceive their driving abilities to be worse than how they actually drive in real-life, then they may prematurely employ self-regulation practices that unnecessarily limits their driving or results in driving cessation (e.g., Choi & Feng, 2018; Siren & Meng, 2013); while older adults who perceive their driving abilities to be better than reality, may display more risky driving behaviors (e.g., Windsor, Anstey, & Walker, 2008). The case of overestimating driving abilities is not necessarily specific to older drivers. Rather, it appears to be a universal problem in that younger drivers have also been reported to be overly optimistic of their driving compared to reality (e.g., De Craen, Twisk, Hagenzieker, Elffers, & Brookhuis, 2011; Matthews & Moran, 1986) and often see themselves as more skillful and less risky drivers than their counterparts (Svenson, 1981). For younger drivers, this may be a result of not having the years of driving experience to perform accurate assessments of their skills (Matthews & Moran, 1986), as well as a lack of awareness of other drivers' abilities that can be used as a basis for comparison (Svenson, 1981). In the case of older adults, who represent a much more heterogeneous group, there is no singular explanation for how and why they form their perceptions of their driving skills. Several possible moderating factors may lead one to draw conclusions about their driving, such as (lack of or) self-awareness of perceptual/physical/cognitive changes (e.g., Brown et al., 2005), feedback/comments from others about their driving (e.g., McPeck, Nichols, Classen, & Breiner, 2011), driving history, including years of experience and accident record (e.g., Marottoli & Richardson, 1998), and/or the perception of repercussions (e.g., Horswill, Sullivan, Lurie-Beck, & Smith, 2013; Joanisse, Gagnon, & Voloaca, 2013).

To date, no systematic review exists that synthesizes the literature on how older adults self-perceive their driving abilities, nor how to assess older adults' perception of their driving. Therefore, this review article aims to synthesize the literature regarding self-perception of driving abilities in older individuals, including the perception that older drivers have about their own driving skills, methods used to measure self-perception, and the relationship between self-perception and real-life driving abilities. Ultimately, this review may inform the development of strategies and/or technologies to best help older drivers (re)calibrate their self-perceived driving abilities.

In this review, we systematically identified and reviewed the literature pertaining to older drivers and their perceptions of their own driving abilities. First, we conducted a comprehensive examination of the various measures utilized by researchers in each study. Second, we synthesized these measures and evaluated similarities and differences between the studies. Third, we compiled this information into a summary table and created an infographic to highlight important findings. We also discussed remaining research gaps in the knowledge base and suggested areas for future research exploration. Finally, we provided brief policy recommendations that can promote road safety.

## 2. Methods

### 2.1. Literature search

This review was conducted using the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) method (Moher et al., 2009) to identify relevant research articles. A total of 10 databases were searched: SCOPUS, TRID, PsycINFO, AgeLine, Web of Science, Abstracts in Social Gerontology, Engineering Village (including both Inspec and Compendex), PubMed, and Medline. The initial search was performed in November 2018, and all databases were last accessed in December 2019. Only peer-reviewed publications were considered in a title, abstract, and/or keywords search, and the search included studies published between the years of January 1979 to December 2019. Only papers published in the English language were considered. Keywords mostly related to self-perception found in the literature (e.g., self-rate, self-assessment, self-perception, self-report, self-awareness, self-efficacy, self-confidence), older adults (e.g., older driver, elderly, aging), and driving (e.g., driving, car, vehicle) were used to search each database. For example, the advanced syntax used for the SCOPUS database, before applying filters for subject areas (limited to those related to human factors and psychology), is as follows: TITLE-ABS-KEY (("self rat\*" OR "self assess\*" OR "self perce\*" OR "self aware\*" OR "self calibra\*" OR "self effic\*" OR "self confi\*" OR "overestim\*" OR "underestim\*" OR "over estim\*" OR "under estim\*" OR "over rat\*" OR "overrat\*" OR "underrat\*" OR "underrat\*" OR "overconfi\*" OR "over confi\*" OR "underconfi\*" OR "under confi\*") AND ("older" OR "elderly" OR "senior\*" OR "aged" OR "aging" OR "ageing" OR "geriatric") AND ("driv\*" OR "operat\*" OR "car\*" OR "vehicl\*" OR "truck\*" OR "automobile\*")) AND PUBYEAR > 1979. This syntax is nearly identical to those used in all other databases.

The initial search resulted in a total of 15,364 papers with 1,032 duplicates, see Fig. 1. Two reviewers independently screened all papers utilizing a general exclusion/inclusion assessment similar to Hawker, Payne, Kerr, Hardey, and Powell (2002). Papers were excluded if they (1) did not include older adults, (2) were related to self-perception in a context other than driving, (3) focused on age and driving self-regulation, given that (a) self-regulation and self-perception are not synonymous and (b) a systematic review already exists on age and driving self-regulation (e.g., Molnar et al., 2015), or (4) investigated interventional strategies regarding driving abilities, since our main goal was to examine the various methods used to assess self-perception of driving abilities and determine how older drivers perceive their abilities. A total of 66 articles were selected for full-text review, including full papers suggested from a subject matter expert (i.e., # of additional records identified through other sources, see Fig. 1). No articles were identified during a legacy search. After the full paper review, an additional 42 articles were excluded for not meeting the inclusion criteria (e.g., papers did not thoroughly discuss nor explore self-perceived driving abilities of older drivers). In total, 25 papers were included in the final review.

### 2.2. Reported data collection methods

The approaches for assessing self-perception of driving abilities in older drivers vary across studies, but with some commonalities. It is important to note that self-perception of driving abilities can only be reported subjectively by a participant, and thus to collect this information, all studies at least conducted a questionnaire, in-depth interview, and/or focus groups. Some studies developed their own questionnaires that often consisted of a series of questions using Likert-based scales (e.g., Ross, Dodson, Edwards, Ackerman, & Ball, 2012); while others adapted previously used questionnaires (e.g., Hickey et al., 2013). In either case, participants were asked to rate their perceived driving ability using an evaluative scale.

For objective data collection methods, driving performance using a real-world, or naturalistic, road task was also used as an assessment tool in many studies either by (1) assigning an unbiased observer to objectively score the driving performance of an older driver (e.g., Wood, Lacherez, & Anstey, 2013), or (2) installing devices into the on-board diagnostic port and/or onto the dashboard to record natural driving patterns (e.g., Blanchard & Myers, 2010). Finally, driving simulations were also used as a means of collecting objective driving performance data (e.g., Freund, Colgrove, Burke, & McLeod, 2005). These driving-based objective measures are used in combination with participant's subjective reports and expert evaluations.

## 3. Results

Table 1 presents all 25 articles reviewed in this study. The main purpose of each study varied in that some were concerned with measuring self-perception, while others focused on the characteristics that influence self-perception. Table 1 provides a summary of the studies evaluated in our review. They are ordered based on the year of the publication (column 2). The table includes information regarding participants (such as age, number of volunteers, and participant grouping criteria where applicable) (columns 3 and 4), measurement of self-perception (e.g., subjective measures based on surveys/questionnaires or objective measures such as driving performance) (columns 5–9), and the main findings from the study related to self-perception (column 10). The results of these studies are discussed in the following subsections. In addition, Fig. 2 is a graphical representation of the summary of findings of all articles reviewed in Table 1.

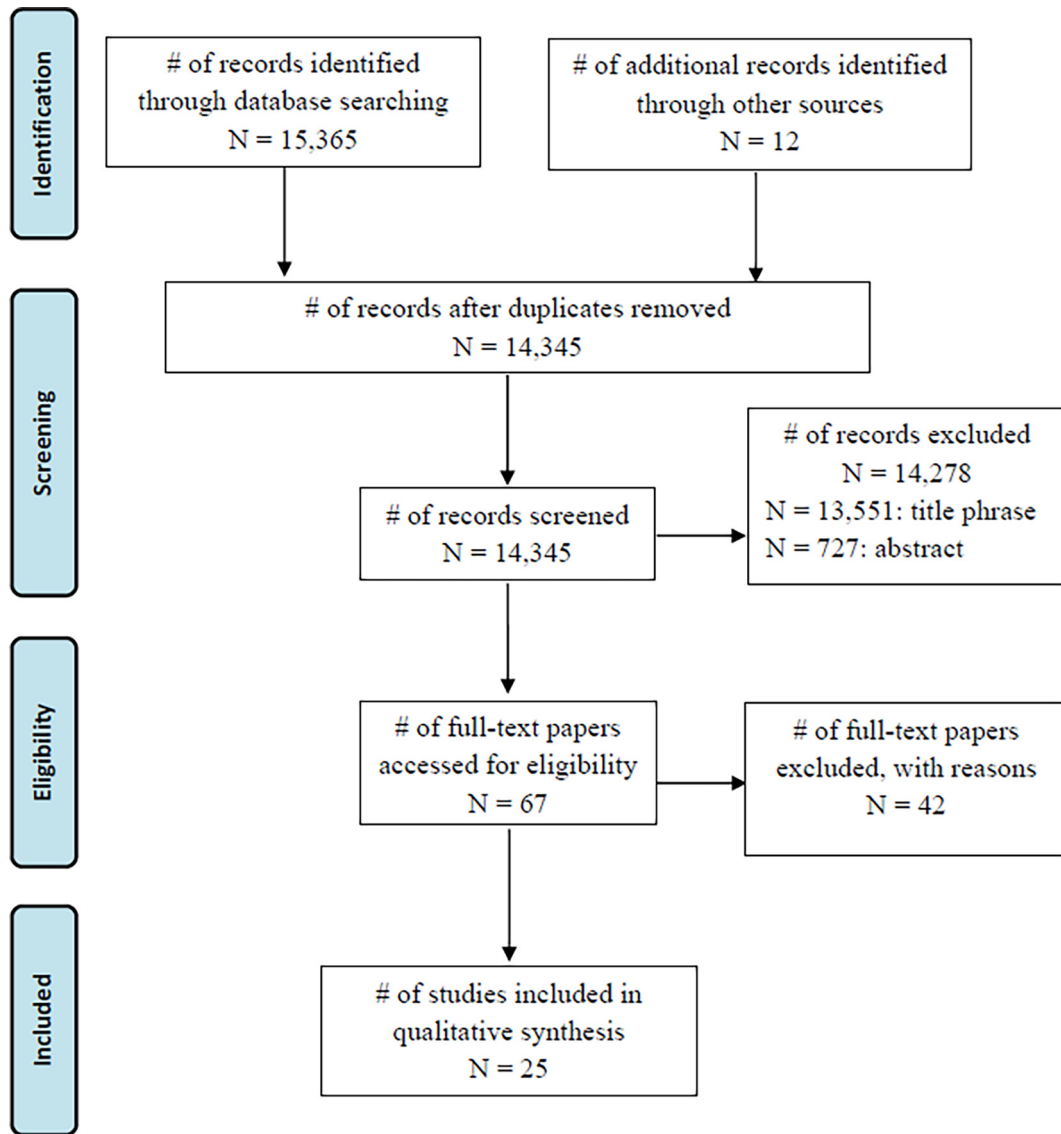


Fig. 1. PRISMA procedure used to select studies for full review and synthesis.

### 3.1. Older drivers' self-perceived driving abilities

Overall, the majority of studies report that older adults self-perceive their driving abilities to be better/higher than themselves at a younger age, their cohorts, and all other drivers, as well as better/higher than their objective driving ability evaluation.

Specifically, for the comparison of older adults' at a younger age, as measured by subjective ratings, most older adults reported that their driving ability either remained the same or became better compared to themselves at their younger age (Ackerman, Vance, Wadley, & Ball, 2010; Blanchard & Myers, 2010; McPeck et al., 2011). For example, Ackerman et al. (2010) measured self-perception of driving abilities twice within a 3-year timeframe and found that 64% of older adults did not change their self-assessments when measured using a general 5-point self-perception questionnaire. Similarly, McPeck et al. (2011) used item-based scales (i.e., Safe Driving Behavior Measure (SDBM)) to assess older drivers' current self-rated driving ability scores compared to 20 years ago, and found that 68% of respondents either maintained the same impression of their driving or believed that their driving skills had improved. Finally, Blanchard and Myers (2010) used a Perceived Driving Ability (PDA) self-perception measure and concluded that older adults' perception of their abilities did not change significantly over a 10-year period.

**Table 1**

Summary of studies included in review on self-perception of driving abilities in older age.

	Author(s) (year)	Participants		Measures of self-perceived driving abilities			Measures of actual driving abilities		Main findings related to self-perception
		n	Mean age (range)	General question (s)	Item (or context)-based question(s)		On-road test/monitor	Driving simulator	
					Non-standardized questionnaire	Standardized questionnaire			
1	Marottoli and Richardson (1998)	125 (interviewed) 35 (on-road test)	81.4 ± 3.27 (–) 80.23 ± 3.02 (–)	–	–	X	X	–	<ul style="list-style-type: none"> <li>100% of drivers rated themselves no worse than other drivers their age</li> <li>Older adults who drove with more frequencies and mileage rated themselves better drivers than their same-age cohort</li> <li>On-road driving performance was not associated with self-ratings of driving ability (e.g., participants rated as having driving difficulties rated themselves no worse than their peers)</li> </ul>
2	Parker et al. (2001)	555	69 (50–90)	–	X	–	–	–	<ul style="list-style-type: none"> <li>More than 60% of older adults reported not experiencing high levels of nervousness or stress while driving</li> <li>15–30% of older drivers rated themselves as “very good” (i.e., the highest level on a 5-point Likert Scale) in all driving situations, compared to 1–5% who rated their driving abilities as poor or very poor.</li> <li>Extroverted older adults were more confident drivers than introverted older drivers</li> </ul>
3	Brown et al. (2005)	75	72.4 ± 10.2 (control) 77.1 ± 5.3 (very mild AD) 73.2 ± 8.3 (mild AD)	X	–	–	X	–	<ul style="list-style-type: none"> <li>Participants with very mild and mild dementia rated themselves more frequently as safe drivers compared to ratings of an informant, physician, and/or instructor</li> <li>No participant with dementia rated themselves as an impaired driver</li> <li>High self-ratings (0 = safe, 1 = marginal, 2 = unsafe) on driving ability assessments correlated with worse on-road driving performance</li> </ul>
4	Freund et al. (2005)	47	77.0 (66–91)	X	–	–	–	X	<ul style="list-style-type: none"> <li>66% of older adults considered themselves to perform better on driving tests than others of the same age</li> <li>Unsafe driving performance increased as self-rated driving preference increased</li> <li>Cognitive ability was not related to self-perceived driving ability</li> </ul>
5	MacDonald et al. (2008)	71	78.2 ± 6.2 (63–93)	–	–	X	–	–	<ul style="list-style-type: none"> <li>Drivers who had a mismatch between self-perceived driving ability and actual functional (psychomotor) ability, i.e., impaired on psychomotor performance but rated their driving abilities above average, had higher driving confidence level and lower driving avoidance rate</li> </ul>
6	Windsor et al. (2008)	304	77.13 ± 7.17 (–)	X	–	–	–	–	<ul style="list-style-type: none"> <li>Older men rated their driving ability higher than older women</li> <li>Self-perception of driving ability was negatively associated with driving risk avoidance, but only in older women</li> <li>No moderating effect of self-rated health on the association between self-perceived driving ability and driving risk avoidance</li> </ul>
7	Ackerman et al. (2010)	426	72.35 ± 5.11 (63–90)	X	–	–	–	–	<ul style="list-style-type: none"> <li>General self-efficacy was positively correlated with self-perception of driving ability</li> <li>Self-perceived driving ability was stable across three consecutive years (compared to baseline data three years prior)</li> </ul>

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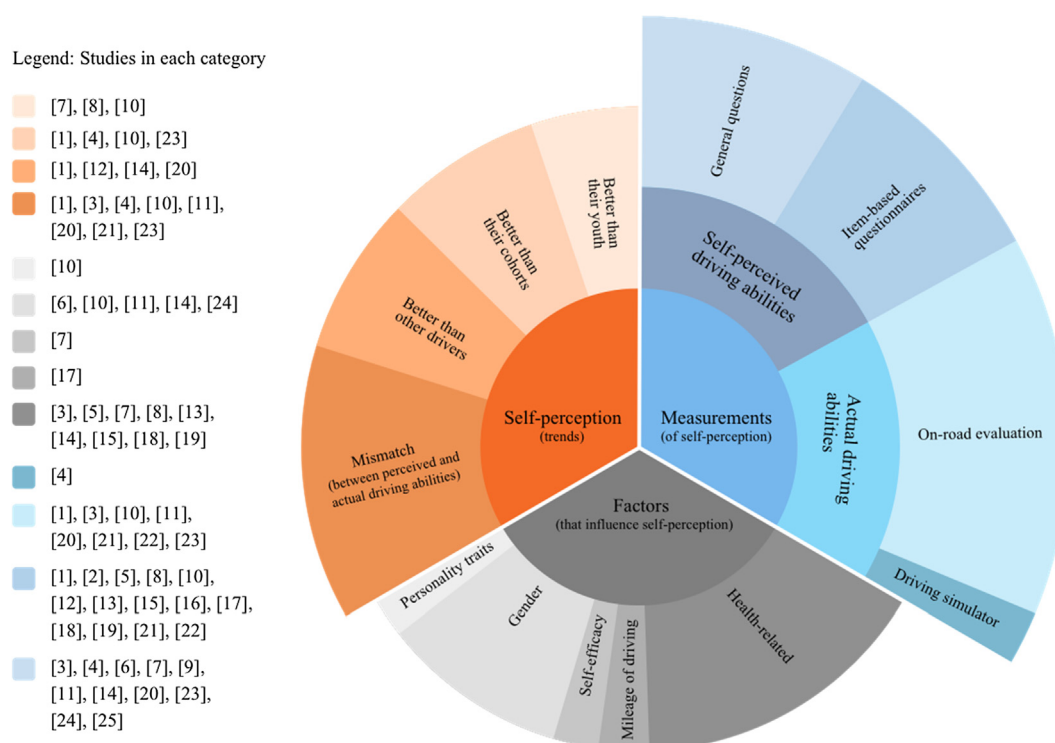
Table 1 (continued)

	Author(s) (year)	Participants		Measures of self-perceived driving abilities			Measures of actual driving abilities		Main findings related to self-perception
		n	Mean age (range)	General question (s)	Item (or context)-based question(s)		On-road test/monitor	Driving simulator	
					Non-standardized questionnaire	Standardized questionnaire			
8	Blanchard and Myers (2010)	61	80.4 ± 5.5 (67–92)	–	–	X	–	–	<ul style="list-style-type: none"><li>Participants with vision disorders rated their driving abilities at night lower than their driving abilities during the day</li></ul>
9	Rashid et al. (2010)	400	59.56 ± 6.68 (–)	X	–	–	–	–	<ul style="list-style-type: none"><li>Higher (perceived) driving ability, good psychomotor ability, better self-rated health, and fewer barriers in the driving environment (e.g., unclear signage, traffic jams, and parking problems) led to more confidence in driving</li></ul>
10	McPeck et al. (2011)	50	72.96 ± 4.78 (66–84)	–	X	–	X	–	<ul style="list-style-type: none"><li>76% of older drivers rated themselves as better drivers compared to other drivers their age</li><li>Less than 50% of older adults rated themselves as having lower driving abilities compared to themselves 20 years ago</li><li>Men rated their driving abilities as higher than women, and also higher than their on-road self-evaluation tests, but no differences in objective on-road evaluation compared to women</li></ul>
11	Selander et al. (2011)	85	72.0 ± 5.3 (65–85)	X	–	–	X	–	<ul style="list-style-type: none"><li>95% of participants rated themselves better than or as good as average drivers, but every 1 in 5 failed the on-road assessment</li><li>Participants who failed the on-road test were, on average, on the higher end of the older age range (i.e., 75.9 vs. 71.0 years), compared to participants who passed their on-road test</li><li>Only 18% of men rated themselves as not good as or worse than the average drivers, compared to 47% of women</li><li>Weak to no correlation between self-perceived driving abilities and actual driving self-rated assessments</li></ul>
12	Sullivan et al. (2011)	98	71 ± 5.13 (65–90)	–	X	–	–	–	<ul style="list-style-type: none"><li>Older adults rated themselves as more skilled than average drivers and other drivers in their cohorts</li><li>Little to no relationship between self-perceived driving abilities and hazard perception skills</li></ul>
13	Meng and Siren (2012)	888	81.3 ± 4.3 (higher functioning) 81.9 ± 4.4 (lower functioning) (75–95)	–	X	–	–	–	<ul style="list-style-type: none"><li>Most participants in both higher and lower functioning groups (calculated by self-rated cognitive function score) reported unchanged driving abilities compared to 15 years ago</li><li>Both functioning groups tended to report declines in lower-level driving skills (e.g., vehicle maneuvering and knowledge of basic traffic rules), and improvements in higher-level driving skills (e.g., on-road decision making)</li><li>Lower functioning individuals were more likely to report improvements to their higher-level driving skills compared to the higher functioning group</li></ul>
14	Ross et al. (2012)	350	73.9 ± 5.25 (65–91)	X	–	–	–	–	<ul style="list-style-type: none"><li>85% of older adults reported their self-perceived driving ability as “good/excellent”</li><li>Older adults with lower self-rated driving scores reported less driving frequency, more medical conditions, and more likely to receive a suggestion to stop or limit their driving</li><li>No relationship between self-rated driving ability and (self-reported) actual driving outcomes</li></ul>

Table 1 (continued)

	Author(s) (year)	Participants		Measures of self-perceived driving abilities			Measures of actual driving abilities		Main findings related to self-perception
		n	Mean age (range)	General question (s)	Item (or context)-based question(s)		On-road test/monitor	Driving simulator	
					Non-standardized questionnaire	Standardized questionnaire			
15	Hickey et al. (2013)	668 (no sleep problems) 194 (with sleep problems)	76.40 ± 4.9 (70–94) 76.02 ± 4.8 (70–94)	–	–	X	–	–	• Self-perception of driving abilities was not affected by the presence of self-reported sleep problems
16	Horswill et al. (2013)	94	71.31 ± 5.03 (65–90)	–	X	–	–	–	• Weak to no correlation between self-perceived and objective (video-based validated) traffic hazard perception • On average, older adults rated themselves as more skilled than other drivers of the same age, gender, occupation, and driving training/experience
17	Langford et al. (2013)	1222	– (>70)	–	X	–	–	–	• Compared to their driving abilities 10 years ago, older adults who drove more miles each year rated their driving abilities to be better than or the same as those who drove fewer miles per year
18	Meng et al. (2013)	25	74.4 ± 7.5 (60–92)	–	X	–	–	–	• Current cognitively impaired drivers were more likely to rate their driving skills as the same or as improved compared to their skills 15 years ago
19	Rapoport et al. (2013)	928	76.21 ± 4.85 (70–94)	–	–	X	–	–	• The Montreal Cognitive Assessment (MOCA) scores were not associated with older adults' self-perceived driving abilities • Time to complete the Trail Making Test had a modest negative association with older adults' perceived driving abilities
20	Wood et al. (2013)	270	75.8 ± 4.0 (–)	X	–	–	X	–	• 98% of older drivers rated themselves as an average or above average driver • 66% of unsafe drivers who were assessed by on-road evaluations self-rated themselves as good drivers
21	Broberg & Willstrand (2014)	40	74.8 ± 3.3 (–)		X	–	X	–	• 89% of participants perceived themselves as good drivers (on a good vs. poor scale), while only 53% of participants were rated as good drivers based on their actual driving performance
22	Koppel et al. (2016)	227	81.53 ± 3.37 (76–96)	–	–	X	X	–	• Older adults with lower actual driving test scores rated their perceived driving abilities as significantly lower
23	Riendeau et al. (2016)	74 (study 1) 29 (study 2)	75.12 ± 6.03 (–) 74.41 ± 5.44 (–)	X	–	–	X	–	• Confidence in driving ability had little relationship to actual driving performance • No driver thought of themselves to have higher risk of crash compared to drivers of the same age
24	Hawley et al. (2018)	142	79.2 ± 3.88 (75–91)	X	–	–	–	–	• Males rated their driving ability higher than females • Older adults rated their driving ability highly
25	Allen et al. (2019)	751	72.2 ± 6.0 (65–97)	X	–	–	–	–	• Older adults were most concerned about the driving behaviors of others on the road (heightened awareness), which increased their perceived driving skills to handle emergency situations





**Fig. 2.** Graphical representation of the summary of findings. The numbers (in brackets) in the Legend correspond to the numbers in column 1 of Table 1, representing each article included in the final list of studies. The three main categories, “Self-perception,” “Measurements (of self-perception),” and “Factors (that influence self-perception),” reflect the summaries from Sections 3.1–3.3 of the Results section, respectively. The relative size of each subcategory represents the proportion of the number of articles identified in that particular main category.

As for the comparison with their cohorts, Freund et al. (2005) reported that 96.6% of older adults thought they were better or at least at the same level as other drivers their age. McPeck et al. (2011) found that only 4% of older drivers rated themselves as worse drivers compared to a cohort. Similar patterns were also observed when older drivers were asked about the likelihood of being involved in a car crash. None thought they were more likely to be involved in a car collision compared to their cohorts (Riendeau, Maxwell, Patterson, Weaver, & Bédard, 2016). Additionally, Marottoli and Richardson (1998) found that all participants rated themselves as an above-average drivers compared to others their age. They also found that older adults with higher driving mileage and frequency rated themselves as better drivers than their cohorts with lower mileage and frequency of driving. With respect to any age group, most older adults believed themselves to have better driving abilities than all drivers of any age (e.g., Marottoli & Richardson, 1998; Ross et al., 2012; Sullivan et al., 2011; Wood et al., 2013).

For objective driving assessments, a mismatch was observed between how older adults subjectively perceived their driving abilities and their actual real-life objective driving abilities in 8 out of the 9 articles that utilized objective comparisons (i.e., Broberg & Willstrand, 2014; Brown et al., 2005; Freund et al., 2005; Marottoli & Richardson, 1998; McPeck et al., 2011; Riendeau et al., 2016; Selander, Lee, Johansson, & Falkner, 2011; Wood et al., 2013). For instance, Marottoli and Richardson (1998) compared older adults’ self-perceived driving ability score with objective driving performance assessed by an experienced driving therapist and found no correlation. In other words, older drivers who were rated as having difficulties on the road by occupational therapists, self-rated their driving abilities either as good as, or better than, their cohorts. Also, Wood et al. (2013) reported that older adults did not yield lower self-perception scores, even though the same group of drivers made more critical driving-related errors (judged by an occupational therapist). Similar conclusions were found in other studies (e.g., Broberg & Willstrand, 2014; Riendeau et al., 2016). This mismatch in perceived versus actual driving abilities also exists between self-rated driving performance (prior to a driving test) and actual driving performance evaluated using a driving simulator (Freund et al., 2005). Only one study (Koppel et al., 2016) found that lower actual driving scores (measured by on-road evaluations) were correlated with lower self-perceived driving abilities (as measured by PDA), meaning that drivers had a more accurate assessment of their skills. However, the authors did not further explain nor explore possible causations.

### 3.2. Measurements of self-perception of driving abilities

The measurement techniques used to assess self-perception were not the same across all studies. In particular, with respect to questionnaires, 11 of the 25 studies used general self-rated questions, such as “how well do you think you can



drive?”, “how would you rate the quality of your driving?”, or “what is the likelihood of you having a car crash?” (Ackerman et al., 2010; Allen, Beck, & Zanjani, 2019; Brown et al., 2005; Freund et al., 2005; Hawley, Smith, & Goodwin, 2018; Rashid, Foon, & Yin-Fah, 2010; Riendeau et al., 2016; Ross et al., 2012; Selander et al., 2011; Windsor et al., 2008; Wood et al., 2013). The remaining 14 studies used items-based questions or scales that focused on specific driving tasks, such as the ability to read road signs, see highway lines, detect objects on the road at night, ingress and egress a vehicle, reverse, or judge headway gaps and speed in traffic (e.g., Langford et al., 2013; MacDonald et al., 2008). These scales included a 15-item Perceived Driving Ability (PDA) scale (MacDonald et al., 2008), a 68-item Safe Driving Behavior Measure (SDBM) scale (Classen et al., 2012), and various self-constructed scales (Blanchard & Myers, 2010; Broberg & Willstrand, 2014; Hickey et al., 2013; Horswill et al., 2013; Koppel et al., 2016; Langford et al., 2013; MacDonald et al., 2008; Marottoli & Richardson, 1998; McPeck et al., 2011; Meng & Siren, 2012; Meng, Siren, & Teasdale, 2013; Parker, Macdonald, Sutcliffe, & Rabbitt, 2001; Rapoport et al., 2013; Sullivan et al., 2011).

Regardless of whether a general self-rated questionnaire or item-based rating was administered, participants were asked to select a value on a scale similar to that of 4-, 5-, or 10-point Likert scales, where the lowest value represents “poor” and the highest represents “excellent” driving abilities. Often, participants were asked to answer the above questions either based on comparisons of their own driving abilities in their youth (e.g., 20 years ago, McPeck et al., 2011), with respect to all other drivers (e.g., Horswill et al., 2013; Sullivan et al., 2011), in contrast with other drivers in their cohorts (e.g., Freund et al., 2005; Marottoli & Richardson, 1998), or in comparison with themselves in different driving situations (e.g., normal situation versus emergency situation, Allen et al., 2019). Here, cohorts represent drivers of the same age (e.g., Freund et al., 2005) or those who with similar/same age, occupation, training, or driving experience (e.g., Horswill et al., 2013).

In addition to self-ratings methods, 9 of the 24 studies also measured driving skills either on road (Broberg & Willstrand, 2014; Brown et al., 2005; Koppel et al., 2016; Marottoli & Richardson, 1998; McPeck et al., 2011; Riendeau et al., 2016; Selander et al., 2011; Wood et al., 2013) or in a driving simulator (Freund et al., 2005). In these cases, the driving was usually evaluated by occupational therapists or trained driving instructors based on particular items, such as attention to road signs, speed compliance, vehicle positioning, or overall driving.

### 3.3. Factors that influence self-perception of driving abilities

Only one of the 25 articles, McPeck et al. (2011), examined how personality traits affect older adults' ability to estimate their driving abilities and driving-related behaviors utilizing the MBTI Step III personality assessment. The authors found that older drivers who identified as extroverts, or highly confident, rated their driving self-evaluations higher than those who identified as introverted, or having low confidence. A different set of 5 of the 24 studies examined gender as a moderator of self-evaluation of driving ability (Hawley et al., 2018; McPeck et al., 2011; Ross et al., 2012; Selander et al., 2011; Windsor et al., 2008). Three of these 5 articles found that men tended to rate themselves more highly than their women counterparts, when self-evaluating their confidence and/or driving abilities, but Ross et al. (2012) did not find any gender differences in the self-ratings between men and women.

Another factor investigated in relation to self-rated driving ability was self-efficacy (i.e. Ackerman et al., 2010), or the belief that one has regarding his/her ability to successfully accomplish a task (Bandura, Adams, & Beyer, 1977; Delhomme & Meyer, 2004). Ackerman et al. (2010) found that after a 3-year study, older adults whose baseline self-efficacy rating was low also rated their driving abilities as low. Langford et al. (2013) compared the self-perceived driving abilities of low (<5001 km/year) versus high ( $\geq 15,000$  km/year) mileage drivers. They found that in all aspects of the evaluation, for example asking questions that relate to being able to travel in unfamiliar areas and locate streets during heavy traffic, high mileage drivers rated themselves as higher ability drivers compared to low mileage drivers.

Finally, 9 of the 25 articles examined the effects of various self-reported medical or health-related conditions, such as physical challenges, cognitive/vision impairments chronic diseases (e.g., Alzheimer's Disease) (Ackerman et al., 2010; Blanchard & Myers, 2010; Brown et al., 2005; MacDonald et al., 2008; Meng & Siren, 2012; Meng et al., 2013; Rapoport et al., 2013; Ross et al., 2012), or sleep problems (Hickey et al., 2013). Sleep problems were not found to affect older adults' self-perception of their driving abilities (Hickey et al., 2013). However, most of the remaining studies do report that drivers who either had more than one medical condition, or experienced greater age-related declines (e.g., cognitive decrements), perceived themselves to have lower/reduced or unchanged driving abilities when compared to themselves in relation to 10, 15, or 20 years ago, but still perceived their driving abilities as better than their cohorts (e.g., MacDonald et al., 2008; Meng et al., 2013; Meng & Siren, 2012; Ross et al., 2012). Here, discrepancies between self-perception and measured performance exist even in populations with physical and/or cognitive impairments. For example, MacDonald et al. (2008) states that adults older than 80 years of age, with 5 of 7 types of cognitive and physical impairments, had discrepancies between their self-rated ability of “good” or “very good” and their objective abilities. For memory-related challenges, Brown et al. (2005) found that compared to the assessments of a physician, instructor, and informant (friend and/or family member), older adults with very mild to mild dementia more frequently rated themselves as safe drivers. Meng and Siren (2012) used self-rated (self-perceived) cognitive function (e.g., concentration, memory, and/or delayed reaction) to divide older adults into lower functioning and higher functioning groups. They found that older adults from both functioning groups showed declines in lower-level driving skills (e.g., vehicle maneuvering) as well as improvements in higher-level driving skills (e.g., on-road decision making), even though those in the higher functioning group did not recognize their declining lower-level driving skills. Few exceptions were identified with respect to individuals with health-related difficulties highly

rating their driving abilities. Particularly, [Ackerman et al. \(2010\)](#) found that osteoporosis, a specific physical health condition leading to weakened bones, to be predictive of self-rated driving ability, and [Blanchard and Myers \(2010\)](#) found that the presence of vision impairments resulted in poor perception of driving abilities.

#### 4. Discussion

This review article synthesizes the current knowledge regarding the self-perception of driving abilities in older age. Relevant information reported from 25 studies included attitudes concerning how older driver perceive their own driving, techniques used to measure self-perception of driving abilities, and factors that influence self-perception of driving abilities. Overall, the studies converge around the notion that older adults tend to think very positively of, and in some cases, overestimate, their driving abilities and skills.

##### 4.1. Tendency of older adults to highly rate their driving abilities

One of the main findings of this review is that the majority of older drivers, regardless of health status, rate their driving abilities very highly. In other words, when asked their opinions of their own driving abilities, the dominate response was positive. This was the case regardless of whether a non-self-assessed measure of driving performance (i.e., determined by using ratings from an expert evaluator during an on-road test or by performance a simulated driving task) confirmed their sentiments or not. Several possible explanations may help to understand this phenomenon.

First, self-ratings of driving ability may not be actually measuring older adults' true beliefs about their driving abilities as a result of self-presentation bias ([Horswill et al., 2013](#)). In general, given the sometimes-negative stereotypes associated with aging, older drivers may try to avoid being associated with populations known to have poor driving abilities ([Joanisse et al., 2012, 2013](#)). In this case, even though they may perceive some form of minor declines in perceptual, cognitive, and/or physical abilities that ultimately result in declines in various driving abilities, their responses to such questions in questionnaires or surveys may not reflect this reality. The bias, and avoidance behavior, can likely lead to an overestimation of their driving abilities. Some older drivers also fear the threats of limited driving privileges and/or driving cessation ([Horswill et al., 2013](#)) and, as a result, may attempt to showcase their driving in a positive light. Alternatively, the presence of age-related cognitive challenges, such the deterioration of metacognitive abilities in older age ([Palmer, David, & Fleming, 2014](#)), may also explain the dominating positive response given by older drivers regarding their driving ability. Metacognition is the awareness of one's own behaviors and thoughts ([Flavell, 1979](#)), and thus declines in the ability to engage in metacognitive reflection can result in false estimations of driving skills. Similarly, decrements in cognition domains, particularly memory, can lead to misrepresentation of driving abilities in that older adults may not remember their everyday driving errors ([Choi & Feng, 2018](#)). Gender differences were also found in how older drivers thought of their driving skills. In particular, 4 out of 5 studies that used gender as a moderator observed that men had higher self-ratings than women ([Hawley et al., 2018](#); [McPeck et al., 2011](#); [Selander et al., 2011](#); [Windsor et al., 2008](#)). One possible interpretation of this finding, provided by previous studies, is that women drive less than men (e.g., [Rimmö & Hakamies-Blomqvist, 2002](#)), which may be correlated with women being more stressed and less confident in driving, in general ([Ferreira, Marmeleira, Godinho, & Simões, 2017](#); [Rimmö & Hakamies-Blomqvist, 2002](#)). It is also important to highlight that the few studies that explored the effects of health-related limitations, such as vision impairments, on self-perception of driving abilities report few exceptions to the high self-rating trend identified across the studies. In general, drivers with such conditions do tend to rate themselves as having poorer driving abilities when asked just about themselves. This may be explained by their heightened awareness as a result of the constant reminder of their own daily health limitations. However, these same participants also rate themselves more positively when asked to compare their skills to other drivers, which could be related to them not being knowledgeable about the abilities of their peers.

One interesting observation is that older drivers are consistently positive about their driving abilities even though significant variability exists between the particular assessment techniques used across studies. As mentioned in the Results section, two different types of subjective measurement techniques are often employed: general self-rated questions and (driving-specific) items-based questions or scales. In the case of general self-rated questionnaires, it has been highlighted that questions contained within them may suffer from ambiguity ([Horswill et al., 2013](#)). For example, if a driver is asked, "how would you rate the quality of your driving compared to your ability 20 years ago?", it is difficult to interpret the correct meaning of the term "quality," and to know whether the question is asked with respect to the overall control/handling of the vehicle or the efficiency of driving from one location to another. For this particular type of question, the time period "20 years ago" may also create both recall and judgement/estimation difficulties for older drivers. In addition, most of the general self-rated questionnaires ask drivers to compare their driving with themselves at a younger age, with their cohorts, or with all average drivers, which may in fact be a measurement of driving self-efficacy, rather than a measure of perceived driving abilities ([Ackerman et al., 2010](#); [McPeck et al., 2011](#); [Ross et al., 2012](#)). Finally, studies that use the self-rated questions approach do not all sample questions from the same database, neither do they use the same comparison basis. Item-based questionnaires or scales, on the other hand, appear to mitigate the concerns raised with respect to general self-rated questions. This is because older adults have been found to be more capable of distinguishing specific driving-related problems on item-based measures of their perceived abilities ([MacDonald et al., 2008](#); [McPeck et al., 2011](#); [Parker et al., 2001](#)). However, even though

the questions on item-based scales are more specific to clearly defined driving maneuvers, many of these evaluations still make use of comparisons, such as inquiring about the ability to see road signs at distance compared to 10 years ago (e.g., [Langford et al., 2013](#)), and thus may also suffer from recall biases. Several authors of studies have also developed their own scales. But most have not systematically validated these questionnaires with respect to strict psychometric examinations ([Blanchard & Myers, 2010](#)), neither have they compared their self-constructed tools with pre-existing scales, such as PDA ([MacDonald et al., 2008](#)).

The finding that older adults assign high ratings to their driving abilities was also highlighted by studies that compared their subjective ratings to on-road driving performance. In particular, experiments that compared self-assessed driving abilities to that of an expert evaluator's rating reported that older adults tend to rate themselves even higher than their evaluator (e.g., [Marottoli & Richardson, 1998](#); [Riendeau et al., 2016](#)). For example, [Wood et al. \(2013\)](#) asked professional driving instructors to assess participants' driving performance based on aspects, such as lane positioning and headway distance selection, and found that drivers who initiated critical errors and needed assistance from the instructor to avoid a crash, still rated themselves as good as all other drivers.

In summary, the tendency to overestimate driving abilities is a robust finding across studies, even with the identified sources of inconsistencies in methods. This further suggests that many self-perception questionnaires may not be measuring true impressions of older adults' driving abilities, but rather one's hypothetical representation of who they think they are, or how they would like to be perceived, as drivers. This also indicates the need to develop more reliable assessment tools that help drivers more accurately estimate, and appreciate, their real abilities (such as more detailed item-based questionnaires without comparisons and/or more iterative verifications of subjective tools with actual driving performance until stronger correlations are observed). One could argue that the only way to truly determine whether or not perception aligns with actual abilities is to compare their self-ratings to objective on-road driving assessments. However, in the papers identified in this review, on-road performance was generally evaluated by driving instructors or occupational therapists (e.g., [McPeck et al., 2011](#); [Riendeau et al., 2016](#); [Wood et al., 2013](#)), which could still represent a quasi-subjective assessment if, for example, the protocols are not standardized in terms of route type, definitions and instructions, and instructors' knowledge regarding the driver. Although many deem standardized protocols as a golden standard for objectively assessing one's fitness to drive, the effectiveness of this approach may be questioned, if these protocols are not being cross-validated with other, more objective, measures of driving performance, such as sensor-based methods. Here, more work is likely needed to define more rigorous objective measurements of driving performance, as well as to collect vehicle dynamics data (e.g., speed and lane position), before researchers can confidently make inferences regarding the perceived versus real-life driving abilities of older adults' driving. However, if the outcomes with respect to overestimation are found to represent ground truth, then it may be necessary to promote interventions, such as educational programs and family member/caregiver feedback ([Hawley et al., 2018](#); [Nasvadi, 2007](#); [Söllner & Florack, 2019](#)) that can help to calibrate drivers' self-perception.

#### 4.2. Lack of validation of age-related differences

Throughout this review, it was noted that none of the papers included younger adult participants as a comparison group. Even though the goal of most of these studies was not to determine age-related differences in self-perceived driving abilities, it is impossible to attribute any findings to the factor of age, as the authors have done with gender, personality, and health conditions. This is especially important given that previous literature, that has employed similar measurement techniques, has found that younger adult drivers also overestimate their driving abilities, but the reasons why the two age groups highly regard their own driving abilities appear to be different. For example, it has been suggested that younger drivers (especially novices) may view themselves as more skillful and less risky drivers than their counterparts ([De Craen et al., 2011](#); [Martinussen, Møller, & Prato, 2017](#); [Matthews & Moran, 1986](#); [Svenson, 1981](#)). Based on these studies, this phenomenon is likely due to a lack of driving experience, coupled with the absence of awareness about what skilled performance means ([Kruger & Dunning, 1999](#)). Also, younger adults may not be knowledgeable about the driving abilities of their peers ([Matthews & Moran, 1986](#); [Svenson, 1981](#)), which can hinder their ability to accurately use this group as a comparison to assess their own driving. [Deery \(1999\)](#) discusses that young drivers tend to adopt more risky driving behaviors, such as driving at faster speeds, and suggests that their inexperience may lead them to unknowingly develop poor perception of risk. Another potential explanation may be that young drivers can often develop good "vehicle-control skills" (e.g., the ability to quickly steer or brake), which results in them confusing this as being a "good driver" ([Brown, 1982](#)). Evidence of senior drivers overestimating their driving abilities, on the other hand, could be driven by self-presentation bias, lack of self-awareness of age-related changes (e.g., [Brown et al., 2005](#)), fear of negative consequences (e.g., [Horswill et al., 2013](#); [Joanisse et al., 2013](#)), or the deterioration of metacognitive abilities or memory (described in [Section 4.1](#)) that can create difficulties in retrieving driving history, such as near misses and accidents (e.g., [Marottoli & Richardson, 1998](#)). As a result, future work should include the participation of younger and middle-aged drivers in same study designs in order to delineate more precisely the other factors and covariates that influence self-perception. These studies should also consider the use of complementary qualitative research methods to more holistically examine the underlying reasons for overestimation.

#### 4.3. Policy recommendations

The findings from this review may ultimately help to inform policy recommendations that keep drivers safe on the roadway. For example, as mentioned in [Section 4.1](#), if overestimation is found to persist, then the development and promotion of interventional programs may be warranted. These programs can make older adults more aware of, and appreciate, their actual driving abilities, and/or could help them to (re)calibrate their perceptions to become more aligned with reality. According to the [National Highway Traffic Safety Administration \(2014\)](#), many states have existing laws and provisions that provide specific licensing requirements for older drivers. However, for policy makers, additional educational programs that either require senior participants, who show signs of a mismatch between perceived versus actual driving abilities, to attend a structured course ([Hawley et al., 2018; Nasvadi, 2007](#)) or that engage senior drivers in training using driving simulation ([Selander, Stave, Willstrand, & Peters, 2019](#)) or a real-world driving, may be considered as part of (re)licensing in older age. Here, instead of relying on standard driving courses used for driving testing (for obtaining licenses), a variety of different driving scenarios (e.g., various weather conditions, road and intersection types, or traffic situations) can be introduced to determine actual driving skills in those conditions. Similarly, regular driving tests, potentially in concert with the timing of primary care appointments, could be administered to track the progression of significant age-related declines. Finally, policy makers can also support legislation that require all automobiles, produced after a certain year, to be equipped with minimum assisted-driving and safety features and technologies that significantly benefit older drivers.

#### 4.4. Limitations

There are some limitations related to the systematic review method that should be acknowledged. First, there is a risk of retrieval bias. Specifically, we only searched for and included peer-reviewed journal articles, and thus information in the gray literature ([Cooper et al., 2019](#)), such as reports, proceedings, dissertations, and theses, may be missing from our synthesis. Similarly, we only included articles written in English, which may have resulted in language bias ([Cooper et al., 2019; Song et al., 2010](#)). However, given that aging is a global issue ([United Nations, 2019](#)), research on older adults' self-perceived driving abilities could also have been included in non-English publications and materials. Finally, even though a systematic search procedure was utilized, there is a possibility that some relevant articles were missed.

### 5. Conclusion

In conclusion, understanding how older adults perceive their driving ability is an important first step for developing strategies to help them examine and calibrate their behavior. Overall, we found older drivers to be mostly positive about their driving skills, whether confirmed by an objective observation or not. While this review provides valuable knowledge regarding older adult drivers, future work should investigate improved subjective and additional objective assessment tools, as well as other factors, such as comfort in driving that may also help to explain how aging populations determine their own driving skills. In addition, better consistency with how researchers utilize synonyms for self-perception (e.g., self-rate, self-assess, and self-awareness), as well as the particular methods used for measuring driving abilities will promote a higher quality of research. Ultimately, this will ensure that cohesive findings are available for safety experts and human factors professionals/researchers who develop practical solutions for maintaining the safety of older drivers.

#### CRedit authorship contribution statement

**Gaojian Huang:** Conceptualization, Methodology, Validation, Formal analysis, Writing - original draft, Visualization. **Maya Luster:** Methodology, Validation, Formal analysis, Writing - original draft. **Ilayda Karagol:** Methodology, Validation. **Jun Woo Park:** Methodology, Validation. **Brandon J. Pitts:** Conceptualization, Writing - review & editing, Supervision, Funding acquisition.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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