Maintaining Driving Capacity in Older Adults

Patricia Santos[1(✉)], Philippe Schneider[2], Vanda Pedrosa[3], Isabel Margot-Cattin[2], Panagiotis Papantoniou[4], Ann-Helen Patomella[5], Elisabete Roldão[3], Ana Frichand[6], Valerii Dembitskyi[7], Nikolas Thomopoulos[8], Anne Dickerson[9], and Isabelle Gelinas[10]

[1] Polytechnic Institute of Beja, Beja, Portugal
patricia.santos@ipbeja.pt
[2] University of Applied Sciences and Arts of Western Switzerland, Lausanne, Switzerland
[3] Polytechnic of Leiria, Leiria, Portugal
[4] University of West Attica, Athens, Greece
[5] Karolinska Institutet, Stockholm, Sweden
[6] Saints Cyril and Methodius University, Skopje, North Macedonia
[7] Lutsk National Technical University, Lutsk, Ukraine
[8] University of Surrey, Guildford, UK
[9] East Carolina University, Greenville, NC, USA
[10] McGill University, Montreal, QC, Canada

Abstract. The demographic shift toward an ageing population highlights the need to sustain mobility, independence, and well-being among older adults. Driving remains central to community mobility and social participation, yet age-related changes challenge safe performance. This paper provides a multidisciplinary reflection on driving in later life, developed within the COST Action Building Opportunities for Participation and Accessibility through Lifelong Community Mobility (BOPALiM – CA23101). It examines functional demands, driving as a social determinant of health, ethical dilemmas surrounding continuation or cessation, and evidence-based strategies to maintain driving capacity.

Evidence indicates that cognitive training, physical conditioning, and self-regulation improve driving performance, while screening tools and continuous monitoring support early risk detection and personalized interventions. The findings support a shift toward individualized, function-based approaches integrated into interdisciplinary care pathways. Ensuring equitable access remains a key challenge. Overall, maintaining driving capacity is framed as a public health priority to promote safety, autonomy, and social inclusion.

Keywords: Older Adults · Driving Capacity · Community Mobility

1 Introduction

The demographic transition toward an ageing population has brought attention to the role of driving as a primary mode of community mobility [1]. Driving is not merely a means of transportation, it is closely associated with health, perceived independence,

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social engagement, well-being [2], and remains central to accessing essential services, sustaining community participation, and preserving connections [3]. The loss of driving capability has been linked to risks of isolation and diminished quality of life health [4].

In developed countries, where private automobiles remain the predominant mode of transportation, most older adults are not planning transition to non-driving status [5]. While road safety concerns persist, emerging studies have shifted the focus toward interventions aimed at maintaining, and even improving, driving capacity in healthy older populations [6]. Evidence shows that simulator training, behavioral workshops, and self-awareness tools can enhance older drivers' safety and confidence [6]. However, driving requires integrated physical, sensory, and cognitive abilities, and their decline challenges the balance between safety and autonomy in later life.

Driving is part of community mobility, enabling access to meaningful activities and supporting social participation and a sense of belonging [7]. It further connects to the notion of life space, described as navigating to places that facilitate community and social participation [8]. As a recognized determinant of health, community mobility and social participation contribute to quality of life and well-being, making the maintenance of safe driving capacity a key issue in aging societies [8].

Mobility in ageing extends beyond functional decline, requiring a broader perspective to understand its links with health and to inform policies that support older adults while ensuring safety. In this context, this paper provides a multidisciplinary reflection on driving in ageing.

The objective of this paper is to provide a multidisciplinary reflection on driving in later life, with the aim of identifying key factors that support the maintenance of safe driving capacity. To guide this reflection, the following research questions are addressed: (i) what are the functional demands of driving in older adults; (ii) how does driving operate as a social determinant of health and participation; (iii) what ethical and policy challenges arise in decisions regarding driving continuation or cessation; and (iv) which evidence-based strategies can support the maintenance of driving capacity in ageing populations.

This reflection forms the basis of ongoing work developed within a funded research network under the European Cooperation in Science and Technology (COST), entitled Building Opportunities for Participation and Accessibility through Lifelong Community Mobility (BOPALiM – CA23101). One of the main objectives of this Action is to explore the importance of maintaining driving capacity among older adults.

2 Driving in the Later Life

This section provides a comprehensive and structured reflection on driving in later life, organized across key thematic domains. It begins by critically examining the functional demands of driving in older adults, highlighting the complex interplay of cognitive, sensory, and physical capacities required for safe performance. It then situates driving as a key social determinant of health and participation, emphasizing its role in sustaining autonomy and well-being. The discussion further addresses ethical dilemmas surrounding driving continuation and cessation, before concluding with an evidence-informed analysis of strategies and interventions to support the maintenance of driving capacity in ageing populations.

2.1 Healthy Ageing and Maintaining Fitness to Drive

Healthy ageing is defined by the World Health Organization (WHO) as the process of developing and maintaining the functional ability that enables well-being in older age [9]. Driving integrates vision, motor, and cognitive functions, requiring coordination across multiple systems [10]. Maintaining driving capacity is therefore a multidisciplinary endeavor involving geriatrics, neuropsychology, and rehabilitation, supported by integrative models to guide fitness-to-drive decisions [11].

Evidence indicates that continued engagement in driving is associated with better self-reported health and social connectedness, whereas sudden cessation may lead to declines in mental well-being and participation [12]. Intervention studies extend these findings by showing that skill-specific training can mitigate age-related declines in driving performance. Simulation-based protocols, behavioral workshops, and self-assessment tools demonstrate measurable improvements in hazard detection, lane-keeping, and self-regulation [6]. Although such interventions reduce crash risk, inconsistencies in outcome measures highlight the need for further research [6].

Recent research further integrates cognitive, physical, and behavioral approaches to sustain safe driving capacity. Digital peg-based Trail Making variants correlate with on-road performance, emphasizing visuomotor speed and cognitive flexibility [13]. Night-time and low-light conditions introduce additional demands, with behavioral and environmental strategies supporting safety and confidence [14]. Simulator studies also show adaptive behaviors, such as conservative gap acceptance and enhanced scanning, reflecting self-regulation strategies [15].

Overall, driving emerges as a key preventive target in ageing, where supporting functional capacities and self-regulation can extend mobility and promote health [16].

2.2 Driving as a Social Determinant of Health and Participation

Driving in later life acts as a social determinant of health by enabling access to services, relationships, and meaningful roles, supporting autonomy and well-being [17]. In car-dependent contexts, driving is essential for functional independence [18].

When older adults stop driving, the impact unfolds across several domains: reduced out-of-home and productive activities, shrinking social networks, and higher risks of social isolation and depressive symptoms [18]. Longitudinal and review evidence shows that driving cessation is associated with declines in social participation and with poorer health-related quality of life [19]. Qualitative and mixed-methods work further indicates that older adults frame driving as part of identity, reciprocity, and contribution to others, not merely as a transport mode [20]. Preserving safe driving is not about resisting change but about delaying disability through participation.

2.3 Safety Vs. Autonomy: Ethical Dilemma

Historically, approaches of “fit to drive” versus “stop driving” have dominated, oversimplifying a complex reality. More recent models advocate graded restrictions, shared decision-making, and monitored interventions prior to cessation. Evidence shows that decision aids improve knowledge, reduce decisional conflict, and align choices with

individual values [1], while their integration into primary care and geriatric services supports timely discussions on adaptation, rehabilitation, and transition planning.

Policy frameworks must ensure procedural justice by clarifying decision authority, evidence, and avenues for appeal. Responsibility is shared among clinicians, occupational therapists, licensing bodies, authorities, and families. Ethically sound pathways should include clear screening thresholds, remediation opportunities, and transparent criteria. Medication safety is also critical, as reviews of sedatives, and polypharmacy can reduce impairment risks and delay cessation [3]. Given ageing heterogeneity, individualized, multidimensional assessments are more appropriate than fixed age limits.

Ethical policy should ensure fair, transparent, and dignity-centered processes. Frameworks such as SUMINI [21] can guide interventions, including decision aids, medication reviews, and graded restrictions, within a continuum of care that promotes autonomy, mental health, and quality of life

2.4 Rehabilitation, Training and Preventive Interventions

Rehabilitation and preventive interventions are key strategies for extending safe driving in later life, with evidence converging on several main categories:

a) Cognitive training and dual-task practice:
   Targeted exercises focusing on set shifting, divided attention, and visuomotor speed show measurable transfer to both simulated and on-road performance [6]. Digital neuropsychological screening can further support individualized programs, as performance on peg-based Trail Making tasks correlates with driving metrics, enabling risk stratification and monitoring [6]. Self-assessment tools, such as the Driving Risk Checklist-25, enhance early detection of cognitive vulnerabilities and guide intervention planning [22], while their validity has been shown to predict on-road performance [23]. These findings highlight cognitive training, supported by validated screening tools, as a cornerstone of driver rehabilitation.
b) Physical conditioning and sensorimotor rehabilitation:
   Physical fitness is linked to safer driving in later life, with interventions improving mobility, pedal control, and hazard response. Musculoskeletal performance has been linked to specific driving maneuvers, suggesting that targeted strengthening may mitigate age-related limitations [24], while frailty contributes to increased injury risk in crashes, reinforcing the need for proactive physical conditioning [25]. Vision-related factors also interact with sensorimotor function, with evidence showing that adaptive strategies and training under glare and mesopic conditions can enhance safety in low-light driving [26].
c) Self-regulation and behavior change interventions:
   Self-regulation helps older adults maintain safe driving despite age-related changes, with workshops and coaching promoting risk awareness and adaptive strategies [6]. Recent studies show that older drivers adapt their driving exposure to perceived risks, reducing night driving, slowing speeds, and increasing scanning at intersections [15]. Additionally, effective self-regulation relies on managing distractions and anticipating hazards. Some authors found that older drivers who received structured feedback improved their ability to anticipate and avoid some situations [27].

In addition to behavioral workshops, technology-assisted feedback is emerging as a promising tool. Studies show that real-time visual feedback systems enhance situational awareness in older adults, particularly during complex driving maneuvers [28]. Similarly, continuous online contact and education programs can reinforce self-regulatory practices by providing sustained guidance and encouragement [29]. Overall, this evidence shows that self-regulation is an active, learnable skill that can be strengthened through structured interventions, feedback technologies, and supportive frameworks.

d) Screening and monitoring.

Continuous monitoring is a promising approach to enhance road safety among older drivers by enabling real-world performance assessment. Eye-tracking metrics can be integrated into real-time feedback systems [28], while structured feedback protocols reduce distraction and improve hazard anticipation [27]. Online programs further reinforce self-regulation, and machine-learning frameworks can integrate environmental, kinematic, and behavioral data to generate individualized risk profiles [29]. Thus, continuous monitoring, via in-vehicle sensors, wearables, or digital platforms, should be viewed not as surveillance but as a preventive and supportive tool.

In this context, rehabilitation programs are most effective when integrated into interdisciplinary care pathways, with evidence showing that coordinated, person-centered interventions can sustain driving capacity. A systematic review highlighted the importance of tailored approaches to improve on-road performance [29], demonstrating that combining cognitive, physical, behavioral, and technological strategies can delay driving cessation while preserving autonomy, social participation, and quality of life.

Emerging technologies, including automated vehicles (AVs) and advanced driver-assistance systems (ADAS), have a multifaceted impact on older adults, requiring consideration of usability, trust, and user perceptions. Exposure can increase trust and willingness to adopt these technologies [30], but concerns remain regarding complexity, cost, and reduced social interaction. Older adults value flexibility and independence, emphasizing user-centered design tailored to their needs [31]. Overall, technological solutions must balance innovation with inclusivity to support safe and independent mobility.

2.5 European Policy Context and Action BOPALiM

Policy debates increasingly recognize driving as a key component of healthy ageing and social inclusion. The COST Action BOPALiM (CA23101) illustrates how transnational collaboration can advance community mobility by fostering knowledge production and dissemination across the lifespan. Aligned with the WHO [9] and the European Commission's road safety framework [32], a coordinated European approach should prioritize standardized screening protocols, referral pathways for driver rehabilitation, guidance on shared decision-making and graded restrictions, and investment in research. Variations in licensing and healthcare systems across Member States, adaptable, principle-based frameworks are essential. Driving capacity remains a public health priority, with technology benefits depending on proper training. At the same time, improving road design and traffic systems [33] and ensuring the access to rehabilitation and monitoring programs.

3 Conclusions

The maintaining driving capacity in later life is both achievable and essential, requiring a shift from age-based restrictions to function-based support. Evidence shows that cognitive training, physical conditioning, and self-regulation improve driving abilities, while screening tools and continuous monitoring enable early risk detection and personalized interventions. Recognizing driving as a social determinant of health supports dynamic, individualized approaches based on graded restrictions and shared decision-making rather than cessation models.

Integrated systems combining clinical assessment, rehabilitation, behavioral strategies, and technological support are crucial, although equitable access remains a challenge, particularly for vulnerable groups. Emerging vehicle technologies offer potential but require appropriate training and user-centered implementation. European initiatives such as COST Action BOPALiM highlight the value of multinational collaboration in harmonizing practices and scaling interventions. Overall, maintaining driving capacity should be a public health priority, requiring coordinated, interdisciplinary strategies.

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