



The development, factor structure and psychometric properties of driving self-regulation scales for older adults: Has self-regulation evolved in the last 15 years?



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ABSTRACT

The term driving self-regulation is typically used to describe the practice of drivers who avoid driving in situations that they regard as unsafe because of perceived physical impairment. Older adults report using this strategy to improve safety while retaining mobility. Self-regulation is typically assessed using the driving avoidance items from the driving habits questionnaire (DHQ) and the driver mobility questionnaire (DMQ-A). However, the psychometric properties of these measures are not well understood. Using data from 277 older drivers, exploratory factor analysis was used to test the homogeneity of three driving self-regulation scales: the DHQ, DMQ-A, and an extended DMQ-A. Good internal consistency for each of the scales was identified (all α s $\geq .9$). A one factor solution was identified for two of the measures (DHQ, DMQ-A) and a two factor solution accounting for over 70% of the score variance was identified for the third measure. The two factors assessed situations that may be avoided while driving because of the “external” (e.g., weather-related) or “internal” (e.g., passenger-related) driving environments, respectively. The findings suggest that the interpretation of an overall summated scale score, or single-item interpretations, may not be appropriate. Instead, driving self-regulation may be a multifaceted construct comprised of distinct dimensions that have not been identified previously but can be reliably measured. These data have implications for our understanding of driving self-regulation by older adults and the way in which this behavior is measured.

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1. Introduction

The number of older adults that rely on driving for transport is projected to rapidly increase over coming decades (Organisation for Economic Co-operation and Development, 2009). This demographic change has important implications for many communities, one of which is how to sustain the mobility and activity of older persons. Self-regulation of driving is one individually-tailored strategy that has been suggested as a means of ensuring safety whilst maintaining mobility (Dickerson et al., 2007).

Self-regulation involves voluntarily restricting one's driving to avoid situations that one considers unsafe. These situations can include driving at night, in the peak hours, or in poor weather conditions (Baldock et al., 2006; Molnar and Eby, 2008; Sullivan et al., 2011). This restriction of driving is assumed to be a response to functional limitations (such as reduced vision or cognitive ability) that the driver recognizes as increasing their risk while driving. Appropriate use of self-regulation may assist older drivers to reduce their crash risk and safely maintain mobility, thereby avoiding the negative outcomes, perceived or otherwise, that may be attributed to premature driving cessation (Edwards et al., 2009).

To date, most studies of older adult's driving self-regulation have operationalized this construct using questionnaires. The driving habits questionnaire (DHQ) (Owsley et al., 1999), and a modified form of this questionnaire known as the avoidance scale of the driving mobility questionnaire (DMQ-A) (Baldock et al., 2006) are the most commonly utilised. The history of the DHQ and

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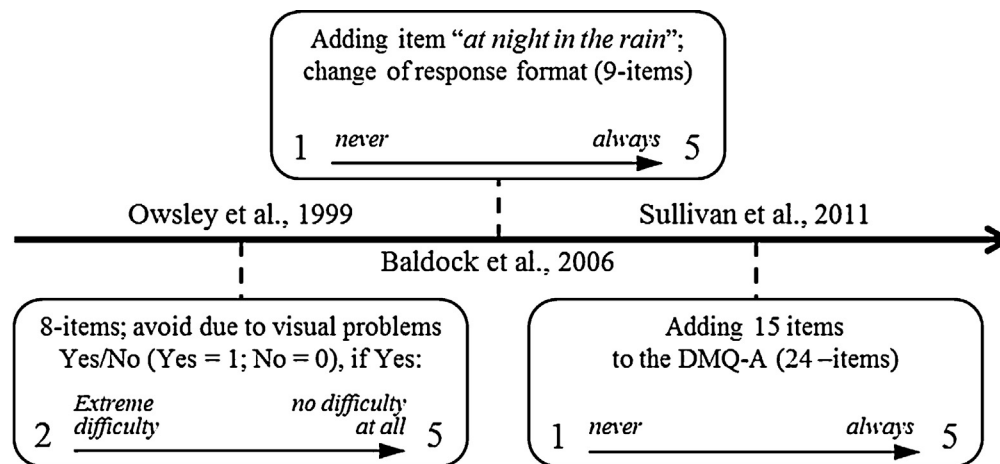


Fig. 1. the evolution of items and response formats to assess driving self-regulation by older adults, highlighting three variants, the driving habits questionnaire (DHQ), the driving mobility questionnaire – avoidance scale (DMQ-A), and the extended DMQ-A.

DMQ-A and their relation to each other is shown in Fig. 1. This figure shows a large degree of overlap in the item content of these scales (the DMQ-A adds one item to the eight items from the DHQ). The DMQ-A adjustment of the DHQ response scale allows participants to indicate that they are avoiding situations for reasons other than their vision. In addition to these two forms of the measure, several extended versions have been created by adding more situations, including those that have been nominated by older drivers themselves. For example, a recent study by Sullivan et al. (2011) described an additional 15 such situations. The use of multiple scales (or item combinations) to assess driving self-regulation by older adults may account for some of the inconsistencies in the literature regarding this strategy (see Wong et al., 2014) for a recent review of the varied use of this measure to assess older drivers' self-regulation). It may also raise questions about how this concept should be assessed and whether the items should be extended or updated as proposed (Sullivan et al., 2011).

The psychometric properties of the DHQ, DMQ-A and its variants are difficult to establish. Owsley et al. (1999, p. 211) reported that the "DHQ's domain 4 items" had a 2-week test-retest reliability of .60 (.44–.74); however, it is unclear how these data should be interpreted. Besides these test-retest reliability data for the DHQ, to our knowledge no further psychometric data (e.g., item-correlations; factor analysis) have been reported for these measures.

Even if scale level data were available, the past use of scores from these tests shows further variation. Most studies operationalise self-regulation as the overall scale score (summed or averaged) of the avoidance items, and, less commonly, it has been measured using a single-item extracted (and/or modified) from the 9-item DMQ-A. The use of summed, or averaged, item scores presumes that self-regulation is a unidimensional construct, with a single underlying factor, although this has yet to be tested. It is possible, instead, that driving self-regulation is multi-faceted. For example, the original DHQ items focussed specifically on driving situations that older adults avoid due to visual problems; however, additional items proposed by subsequent research including those nominated by older adults themselves (e.g., avoiding driving with passengers) may suggest other reasons for driving self-regulation. The driving situations that older adults avoid because of perceived cognitive limitations, for example, could include high traffic roads, peak hour driving, or situations that involve navigational challenges (e.g., roundabouts). These situations may be different from those that are avoided because of visual acuity problems (e.g., night time driving, driving into the sun). Driving self-regulation by

older adults could also include the use of other compensatory strategies (i.e., not just reducing the amount or location of driving, but using alternative transport or riding with others), which would support the idea that situations are avoided for reasons other than vision. It is also possible that the current pool of driving avoidance items – including those that have been recently proposed – contain items that are statistically redundant, yet could contribute to response biases (for example, due to fatigue or response set). An investigation of the DMQ-A factor structure would further our understanding of the construct/s underpinning older adults' driving self-regulation.

The purpose of this study was to explore the concept of driving self-regulation by older adults, and focus on its measurement. Specifically, the study aimed to investigate the internal consistency and factor structure of three self-regulation item sets: 1) the original 8-item DHQ, 2) the 9-item DMQ-A, and 3) the extended 21-item DMQ-A.

2. Method

2.1. Participants

The participants were 277 older adults (63% female, age range: 65–92 years, $M_{\text{age}} = 71.64$; $SD = 5.87$) recruited from the community in response to newspaper and email advertisements, fliers distributed via a range of organisations (e.g., Country Womens' Association, Council On The Aging and Health Clinics). Eligible participants were current drivers and aged 65 years or older. Potential participants were told that the research was interested in their opinions on the driving experience and the transportation needs of older drivers. The response format of the questionnaire include postal survey ($n = 108$; $M_{\text{age}} = 72.04$; $SD = 7.21$) and web-based questionnaire ($M_{\text{age}} = 70.95$; $SD = 5.85$). The demographic characteristics of participants appear in Table 1.

2.2. Materials

2.2.1. Extended DMQ-A

An extended version of the avoidance items of Baldock et al.'s (2006) DMQ was used to assess participants' self-regulation. Twelve new items from the set generated by Sullivan et al. (2011) were added after the items from the DHQ/DMQ-A. These 12 items were selected because they described situations that have also been used in previous studies of older drivers' self-regulation (Braitman and Williams, 2011; Horswill et al., 2011; Kostyniuk and

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