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# Highlights

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**Comparison of self-report and objective measures of driving behaviour and road safety: A systematic review**

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- Reviewed 20 studies which used self-report and objective measures of driving behaviour
- Evaluated if disparities or similarities existed between measurements
- Evidence from studies were mixed, with some similarities and some disparities
- More research is needed to examine the correspondence between these measurements.



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# Comparison of self-report and objective measures of driving behaviour and road safety: A systematic review

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## 1. Introduction

Motor vehicle crashes contribute to a large proportion of serious injuries and deaths worldwide. It has been estimated that road crashes[1] account for approximately 1.25 million deaths each year, with 20–50 million injured as the result of a road crash (World Health Organization, 2016). As such, there has been an extensive amount of research which has assessed on-road driving behaviour. Much of this research has, however, relied heavily upon self-report measures. Such measurements may be subject to response biases including social desirability effects (i.e., presenting a favourable image of oneself; Van de Mortel, 2008) and recall biases (i.e., inaccuracies of recall). Despite these limitations of self-report measures, some researchers have argued that self-report measures are reliable indicators of driving behaviour (Taubman-Ben-Ari and Prato, 2016).

More recently, technological advancements have enabled the availability of a range of driving-related measurement techniques to objectively measure driving behaviour (e.g., in-vehicle devices, driving simulators, and on-road vehicles). Previous research has reported that in-vehicle devices, used with or alongside Global Positioning System (GPS) technology, are a valid and reliable measure to assess driving exposure and driving practices in older drivers (Agramunt, Meuleners, Chow, Ng, and Morlet, 2016; Molnar et al., 2013). Further, Marshall et al. (2007) found that not only do in-vehicle devices provide a more comprehensive view of driving exposures and practices than a self-report driving diary, but older drivers rate the convenience and comfort of these devices more favourably than a self-report driving diary. However, a disadvantage of in-vehicle devices is that it may be difficult to determine who was driving the vehicle at time of measurement (Marshall et al., 2007).

In addition to driving-related measurement techniques, physiological measures such as electrocardiography (ECG; heart rate) and skin conductance level (SCL), and neurological measures such as electroencephalogram (EEG), have been used in road safety research to objectively assess underlying physiological and neurological responses. For instance, ECG and SCL have been applied to assess drivers' underlying arousal responses towards threat-based road safety advertisements (Carey and Sarma, 2016). In terms of neurological measures, EEG measures brain activity by detecting electrical signals of the cerebral cortex. These signals can be converted to brain waves (e.g., alpha waves) which can be used to monitor brain functions during experimental tasks. EEG has been used in road safety research to monitor micro sleep episodes (Moller, Kayumov, Bulmash, Nhan, and Shapiro, 2006) and to assess driver vigilance states during prolonged driving (Schmidt et al., 2009).

Given the continued technological advancements in road safety measurement techniques, it is timely to review the utility of these objective measures in assessing driving behaviour. Thus, this research systematically reviewed the existing literature in regard to studies which have used both self-report and objective measures of driving behaviour. The objective of the current review was to evaluate disparities or similarities between self-report and objective measures of driving behaviour. To the best of the authors' knowledge, this paper is the first to review studies comparing self-report and objective measures of driving behaviour.

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[1] Road crashes include motor vehicles, motorcyclists, and vulnerable road users (e.g., pedestrians and cyclists).

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