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How indicative is a self-reported driving behaviour profile of police registered traffic law offences?

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ABSTRACT

Although most motorised countries have experienced massive improvements in road safety over the last decades, human behaviour and differences in accident risk across sub-groups of drivers remains a key issue in the area of road safety. The identification of risk groups requires the identification of reliable predictors of safe or unsafe driving behaviour. Given this background, the aim of this study was to test whether driver sub-groups identified based on self-reported driving behaviour and skill differed in registered traffic law offences and accidents, and whether group membership was predictive of having traffic law offences. Sub-groups of drivers were identified based on the Driver Behaviour Questionnaire (DBQ) and the Driver Skill Inventory (DSI), while traffic offences and accidents were register-based (Statistics Denmark). The participants ($N = 3683$) were aged 18–84 years and randomly selected from the Danish Driving License Register. Results show that the driver sub-groups differed significantly in registered traffic offences but not in registered accidents. In a logistic regression analysis, the sub-group "Violating unsafe drivers" was found predictive of having a traffic offence, even when socio-demographic variables and exposure were controlled for. The most important predictive factor, however, was having a criminal record for non-traffic offences, while gender, living without a partner, and being self-employed also had a significant effect. The study confirms the use of the DBQ and DSI as suitable instruments for predicting traffic offences while also confirming previous results on accumulation of problematic behaviours across life contexts. The finding that driver sub-groups did not differ in registered accidents supports the recent research activities in finding and modelling surrogate safety measures.

1. Introduction

Human behaviour is a key factor in 80–90% of road traffic accidents (e.g., Rothengatter, 1997; Shinar, 2007). For the development of effective preventive measures, it is therefore crucial to know which types of driving behaviours are problematic in the context of road safety and which sub-groups of drivers perform these behaviours.

Several studies have identified sub-groups of drivers using self-report measures. In a recent study, Martinussen et al. (2014) applied two self-report measures to identify sub-groups of drivers that differ in their propensity to drive in aberrant ways: the Driver Behaviour Questionnaire (DBQ, Reason et al., 1990) and the Driver Skill Inventory (DSI, Lajunen and Summala, 1995). The study identified four driver sub-groups of which two stood out as potentially more unsafe than the other two sub-groups: the "Violating unsafe drivers" and the "Unskilled unsafe drivers". These two groups reported the highest levels of aberrant driving behaviour, and lowest technical driving skills or safety skills, or both. They also reported significantly more accidents and fines. As comparably safe driver groups "Skilled safe drivers" and "Low confidence safe drivers" were identified (for details, see Martinussen et al., 2014).

However, this study did not answer the question whether the group differences based on self-reported data were also related to traffic offences and accidents as reported by the police. This question is relevant, as self-reports on driving behaviour and accident involvement have been criticised as a method because persons may modify their answers for social desirability reasons, may remember episodes incorrectly (memory bias), and may want to report consistently across related measures (common method variance, CMV) (af Wåhlberg, 2010; af Wåhlberg et al., 2011). More specifically, the usefulness of the DBQ has been questioned because of its limited ability to predict accidents (af Wåhlberg et al., 2011; af Wåhlberg and de Winter, 2012). In a recent paper, af Wåhlberg

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et al. (2015) concluded that DBQ's predictability of accidents was driven by an exposure effect: drivers with a high number of violations did not violate more, they just drove more while violations per kilometre were not higher, which stresses the necessity to control for mileage when comparing self-reported driver behaviour. af Wåhlberg et al. (2015) suggested further research was needed where DBQ data should be compared with registered data, thereby not susceptible to CMV.

With the unique opportunity in Denmark of combining register data from Statistics Denmark to survey data such as the DBQ and DSI on a representative sample of the population, this study examined whether the differences between driver sub-groups as identified by Martinussen et al. (2014) were observed also when comparing police registered traffic offences and accidents. Moreover, we examined to what extent possible differences between the four sub-groups of drivers in registered traffic offences could be explained by differences in their socio-demographic characteristics (i.e., age, gender, living with a partner, income, education, living in Copenhagen, and car ownership as well as having a criminal record for non-traffic offences) and mileage; that means whether group membership was (still) predictive of traffic violations, when demographics and exposure were controlled for. More specifically, we formulated the following hypotheses:

Hypothesis 1. The driver sub-groups identified as unsafe based on self-report data ("Violating unsafe drivers"; "Unskilled unsafe drivers") have more registered traffic law offences and accidents than the two safe groups.

Hypothesis 2. When predicting traffic law offences based on group membership, belonging to one of the unsafe groups has still a significant effect on registered traffic law offences, when socio-demographic factors are controlled for.

Hypothesis 3. When controlling for exposure, the effect of "Violating unsafe drivers" (the group with the highest mileage) is no longer significant.

The results were expected to shed light on the validity of the identified driver sub-groups and thereby also indirectly on the instruments the groups were based upon, namely the DBQ and DSI. In addition, the analyses were expected to reveal which socio-demographic characteristics were predictive for registered traffic law offences, providing additional knowledge for the design and targeting of preventive measures.

2. Method

2.1. Participants

The sample consists of 3683 persons who took part in a survey on driver behaviour and could afterwards be matched with data from Statistics Denmark. Originally, 11,004 individuals aged 18–84, randomly drawn from the Danish Driving License Register (stratified by age and gender) received a letter announcing the study together with the questionnaire, a freepost return envelope, and a web address to return the questionnaire online if preferred. Two reminders were sent. The response rate was 44 percent. Of the 4849 respondents who returned a questionnaire, 941 (19%) had to be excluded as they did not complete the full questionnaire and of these 225 (5%) had to be excluded as they could not be matched with data from Statistics Denmark, resulting in the final sample of 3683. Additional details about the sampling process can be found in Martinussen et al. (2013, 2014), while characteristics of the sample can be found in Table 1.

Table 1
Sample Characteristics.

Variable	Categories	Percentage
Age	18–24 years old	10.1%
	25–34 years old	11.9%
	35–44 years old	15.5%
	45–54 years old	17.3%
	55–64 years old	17.5%
	65–74 years old	16.1%
	75–84 years old	11.6%
Gender	Female	47.6%
	Male	52.4%
Household	Living alone	21.9%
	Living in a multi-person household	78.1%
Living in Copenhagen	Yes	93.3%
	No	6.7%
Education	Low	65.1%
	Medium	23.1%
	High	8.2%
	Other	3.6%
Employment status	Employee	59.3%
	Self-employed	5.4%
	Retiree	28.5%
	Unemployed	4.8%
	In education	2.0%
Car ownership	Yes	67.6%
	No	32.4%
Mileage (self-reported)	until 6000 km/year	29.4%
	6000–12,000 km/year	25.5%
	12,000–18,000 km/year	15.8%
	18,000–24,000 km/year	10.8%
	more than 24,000 km/year	18.5%
Traffic offences	Yes	10.8%
	No	89.2%
Criminal record	Yes	2.7%
	No	97.3%

2.2. Measures

Sub-groups of drivers were identified based on a cluster analysis of self-reported answers to DBQ and DSI. The DBQ was used to assess aberrant driver behaviour by asking how often the drivers performed violations, errors and lapses on a six-point scale (0 = never, 5 = nearly all the time) across different driving situations (for details see Martinussen et al., 2014; Reason et al., 1990).

The DSI was used to assess perceptual-motor skills and safety skills by asking drivers to assess how skilful they considered themselves to be compared with the average driver across different driving situations. A five-point scale (0 = well below average, 4 = well above average) was used (for details see Lajunen and Summala, 1995; Martinussen et al., 2014). Based on their answers to the DBQ and the DSI, the participants were clustered into four groups of drivers ("Skilled safe drivers", "Violating unsafe drivers", "Unskilled unsafe drivers", "Low confidence safe drivers") as described in the introduction and in more detail in Martinussen et al. (2014). The names of the clusters reflect their scores on the two scales (e.g., skilled safe drivers = high score on skills/DSI and low score on aberrant driving behaviour/DBQ).

In this study, for each participant register based information was derived from Statistics Denmark and added to the survey data of the respective person. The information included demographic information (income, education, family status, and car ownership), accident involvement (police registered injury and fatal accidents), registered traffic law offences, and having a criminal record resulting from non-traffic offences. The register based information on demographics was taken from the year in which the participant