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Do drivers differ in their attitudes on speed limit compliance between work and private settings? Results from a group of Nigerian drivers.

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Abstract

Existing evidence suggests that drivers, particularly those who work in companies with strong road safety cultures exhibit different sets of speeding attitudes and behaviours in work and private driving. Using Ajzen and Fishbein's (1980) Theory of Planned behaviour (TPB) and on-road driving experiments, this study examined the self-reported and objective behaviour of driving within posted speed limits for a sample of fleet drivers. The findings show that the TPB explained up to 24% of the variance in intention to comply with speed limits. Drivers' attitude emerged as the most significant predictor and strongest correlate with intentions to comply with the speed limit in both work and private vehicle.

Further analysis revealed participants had a higher intention to comply with speed limits in their work than private vehicle. Also, investigation of the relationship between TPB variables and observed speeding behaviour suggests that participants with higher intention to comply with the speed limit or high perceived behavioural control (PBC), exceeded the speed limit less often than those with lower intention to comply with the speed limit or low PBC. The findings have important theoretical and applied implications for development of better speed limit compliance interventions to improve driving behaviour, and road safety in general.

Keywords: Speeding behaviour, Theory of Planned Behaviour, Road safety.

1 Introduction

Road traffic crashes have been listed as one of the main contributors to work-related fatalities. Police accident data show that every year, almost a third of road deaths (500) in the UK involve drivers or riders who are driving for work (RoSPA, 2018). Work-related road traffic deaths are

estimated to account for 33% of work fatalities in Australia, 22% in the United States, and 16% in New Zealand (Driscoll, Marsh, McNoe, Langley, Stout, Feyer, and Williamson, 2005). The situation is worse in low- and middle-income countries such as Nigeria, where, according to the Federal Road Safety Corps (2017), 60% of vehicles in road traffic crashes are being driven for work purpose.

Work-related drivers have been described as those who drive at least once per week for work purposes (Haworth, Tingvall, and Kowadlo, 2000), and include those who drive public transport services, courier, police, company and government cars, emergency services and those who drive their private vehicles for work-purposes. Therefore, it has become necessary to investigate the determinants of work-related crashes so that effective interventions can be implemented.

2 Traffic Safety Culture

The relationship between organisational factors and risky driving behaviour in occupational settings have been examined by several studies. The concept underpinning these studies is that; the culture of an organization greatly affects their employees' decision-making and behaviour (Casey, Griffin, Flatau Harrison, & Neal, 2017). A study by Downs, Keigan, Maycock, and Grayson, (1999), found that, while the driving culture in some organisations puts business needs such as delivery quotas before safety needs, in other organizations factors such as environmental concerns and delivery of expensive or dangerous materials motivate increased safety consciousness. The study also found that "the safety culture of an organisation is critical in determining how organisations address safety problems and how satisfied they are with the outcome" (Down et al, 1999, p. 15). This is supported by Haworth et al. (2000) who propose that the safety culture of a company can have a significant impact upon attitudes towards driver safety and safe driving behaviour.

A study by the Department for Transport (2004), investigating the relationship between organizational safety culture, worker–driver attitudes, and accident risk in Great Britain, concluded that there is a moderate relationship between safety culture and attitudes, and between attitudes and accidents, with great potential for improving traffic safety. Newnam, Watson, and Murray (2002) found drivers who work in organisation with a strong safety culture

reported overall safer driving behaviour in a work vehicle than those with less strict safety policies in place. Mokarami et al. (2019), examined the causal relationship between aberrant behaviors by public transportation drivers in Iran and organizational safety culture. Their results revealed a negative relationship between safety culture and crashes, with promotion of a safety management system likely to improve the employees' safe behaviors.

Edwards, Davey, and Armstrong (2013, p.77), proposes a synthesised definition of safety culture as “the assembly of underlying assumptions, beliefs, values and attitudes shared by members of an organisation, which interact with an organisation’s structures and systems and the broader contextual setting to result in those external, readily-visible, practices that influence safety”. In the context of road transportation, *Traffic Safety Culture* (TSC) is an emerging concept, which is gaining traction among road safety experts and offers great potential for improving traffic safety (Edward et al., 2014; Islam et al., 2017). According to Edward et al. (2014), TSC can be described as consisting of elements of national culture which influence traffic safety” (p. 295). Thus, to be able to transform the TSC of a population, there is need to measure the prevailing beliefs, values and attitudes shared by members of that population, and identify areas that require improvement.

2.1 Theory of Planned Behavior (TPB) and context of current study

Excessive speed is a major contributory factor to road accidents, injuries and deaths across the world. Also, many studies have demonstrated that speeding is the most common work-related risky driving behaviour (Wishart, Davey, and Freeman, 2006; Lajunen, Parker, and Summala, 2003; and Stradling, 2000). According to Adams-Guppy and Guppy (1995), work-related drivers are more often faced with time-pressures than other drivers, which reflects a potentially important utility in their driving-based decision-making, with a likely consequence for behaviours such as speeding. However, Newnam, Watson, and Murray (2004), using Ajzen and Fishbein’s (1980) Theory of Planned Behaviour (TPB), carried out one of the only other similar studies examining the factors influencing driver’s speeding behaviour in work and private settings. Results showed, drivers in their study had a higher intention to speed in their private vehicles than when using a work vehicle. According to the TPB, volitional behaviour, is to a large extent,

determined by intention; which is summary of the motivation or willingness to perform the behaviour and the Perceived Behavioural Control (PBC); which is people's perception of their ability to perform the behaviour. The TPB holds that Intention is independently determined by the cognitive variables of Attitude; which is the degree to which a person has a positive or negative evaluation to performing the behaviour, Subjective Norm; the perceived social pressure by significant others to perform or not perform the behaviour) and PBC. Newnam et al. (2004), also report that drivers in their study were relatively more likely to receive pressure by significant others to speed in a personal vehicle than in a work vehicle. Their findings also show the components of the TPB to be more influential in predicting speeding behaviour in drivers who work for companies with more extensive organisational policies and practices than those with fewer. However, it remains unclear if these findings can be readily applicable in low-and middle-income countries (LMIC) which according to Lund and Rundmo (2009) have drivers with higher risk perceptions due to their overall higher exposure to risky and unsafe traffic conditions.

A major criticism of past TPB studies have been the use of self-reported measure of behaviour. Although self-reports are widely recognized as an efficient methodology in traffic and safety studies, they are known to be vulnerable to a few biases that can lead to both under- and overreporting, particularly in relation to aberrant, or potentially criminal forms of behaviour such as speeding (Elliot et al., 2007). According to Conner et al. (2007) self-report can lead to an overestimation of the relationship between intentions and behaviour. Thus, it is particularly valuable to identify the impact of self-reported TPB variables and objectively measured speeding behaviour. A meta-analysis of the TPB by Armitage and Conner (2001), found that intention and perceived behavioural control were relatively poor predictor of observed speeding behaviour assessed from traffic records (accounting for 20% of the variance, on average) compared with self-reports (accounting for 31% of the variance, on average). However, a driving simulator study by Elliot et al. (2007) reported intentions significantly predicted observed speeding behaviour accounting for between 31-39% of the variance. However, this rose to 67% for self-reported speeding behaviour. Although both Armitage and Conner, 2001; Elliot et al., 2007 studies support the argument that self-report can lead to an overestimation of the relationship between intentions and behaviour. It is worth noting that the variance in Elliot et al. study was between

11 and 19 percentage points greater than that found by Armitage and Conner. A possible explanation is that the behavioural measure used in the latter study were likely to have been a more reliable assessment of speed over entire driving route than those observed in the former (Elliot et al., 2007). It will therefore be valuable to explore the prediction of TPB variables with speeding behaviour assessed from in-vehicle speed monitoring linked to systems to locate a car on specific road governed by a speed limit and in real traffic.

Accordingly, the present study was divided into two parts of subjective and objective behavioural data collection. It involved examining the predictors of speeding behaviour in the work and private vehicles of Nigerian drivers who work in a company with a strong safety culture using self-reported TPB-based questionnaire, and their association with objectively measured speeding behaviour obtained by means of GPS logged data from on-road driving, (driver's speeding behaviour was not objectively measured in their work setting due to company privacy policies).

3 Methods

3.1 Participants

Participants were sampled from drivers who work for a large multi-national oil and gas company operating in Nigeria with strict safety policies across the whole company including Nigeria. According to Downs et al. (1999), the transportation of hazardous and expensive materials by such a company and environmental concerns makes them more active in driver safety and strict safety culture. As part of the recruitment process, 150 paper questionnaires were distributed through driver representatives. Sixty-eight drivers returned their questionnaires completed, thus, indicating interest in participating in the study. Unfortunately, only 20 of those drivers who returned their questionnaire participated in the on-road driving phase.

The relatively low response rate of 45% was due to participants personal circumstances with respect to car ownership (i.e. drivers needed to drive a private vehicle at least once a week to participate in the study). While the low on-road test drives (13.6%) was in part due to considerable complications with participants work/private schedules (participants were only

available on weekends), and the study was also limited by time and finances. However, the 20 drivers who completed the study were representative of the whole group.

All participants were males (demonstrating that fleet and commercial driving is an exclusively male dominated sector in Nigeria). Over 80% of the participants were above the age of 36 with a maximum age of 55. Participants had an average driving experience of 17 years with 85% of them having driven for a fleet company for the past 5 years. They reported an average of 20,000-kilometre work mileage and 15,000 kilometres private vehicle mileage.

3.2 Design of Questionnaire

Fishbein and Manfredo (1992) propose that people's beliefs about a behaviour will always vary and more importantly, from population to population, as beliefs cannot be assumed to be transferable among different populations. Thus, the need for elicitation studies of the population beliefs to be carried out wherever the TPB is to be used to predict behaviours. Through three focal group discussions, salient beliefs underpinning speeding behaviour among Nigerian drivers were elicited and informed the foundation for the design of the direct-based-measure TPB questionnaire. Key findings from the focus group discussions indicate that although speed limit compliance was perceived as being socially acceptable with perceived advantages, participants still believed they were personal gains from violations irrespective of the adverse negative consequences. Family members, employers and enforcement agencies were important others who encourage speed limit compliance. Bad road infrastructure and time constraints were identified as factors that ease and impede the behaviour respectively. (Only findings relevant to the reported analysis are discussed, detailed results of the elicitation study are discussed in a separate work under review).

The questionnaire also adapted standard items used in previous studies by Parker, Manstead,

Stradling, and Reason, 1992; Newnam et al., 2004; Stead, Tagg, MacKintosh, and Eadie, 2005. The questionnaire comprised of 6 sections collecting information relating to participants' general driving demographics, attitudes and behaviour in relation to speed limit compliance in both driving in work and private settings. Section one elicited demographic information regarding weekly driving, mileage, vehicle type and age. Section two elicited participant's perception to their organisation safety policies. Section three measured participants self-reported speed limit compliance behaviour in work and private vehicles. Section four and five independently examined the Theory of Planned Behaviour (TPB) constructs (Attitude, subjective norm and PBC) in work and personal vehicles with a preceding hypothetical scenario methodology used by Parker, Stradling, and Manstead (1996). Section six elicited participants intentions to comply with speed limits. Attitudes, subjective norm, PBC and intention were measured using 5-point Likert scales of 1, "strongly disagree" to 5 "strongly agree", with a high score indicating a variable is favourable towards speed limit compliance. Self-reported behaviour was measured using a 5-point Likert scale of 1, "every time" to 5 "never" (high score indicating high levels of compliance with speed limits). However, to reduce response bias or tendencies of social conformation some items were negatively phrased.

Table 1:TPB items measured

S/N	Items
Attitudes	
1	Respecting the speed limit reduces the chance to get involved in a crash.
2	Respecting the maximum speed limit makes you drive in a more relaxed way.
3	It is Ok to exceed the speed limit as long as you drive carefully.
4	Exceeding the speed limit would help me arrive my destination more quickly.
5	It is OK to exceed the speed limit as long as you don't have passengers in the vehicle.
6	Respecting the speed limit makes you need more time to reach your destination.
7	<i>I would favour stricter enforcement of the speed limit on all roads.</i>
8	Exceeding the speed limit would make me feel excited.

Subjective Norm	
7	The boss would think that I should speed 10 km/h over the limit.
8	Other work drivers would think that I should speed 10 km/h over the limit.
9	Family members would think that I should speed 10 km/h over the limit.
10	<i>The police/ FRSC would think that I should speed 10 km/h over the limit.</i>
Perceived Behavioural Control	
11	I am more likely to exceed the speed limit if I am in a hurry.
12	I find it difficult to keep to the speed limit if the traffic around me is going faster than the speed limit.
13	<i>I find it difficult to comply with speed limits when the road network is good.</i>
Intention	
14	I intend to drive within the speed limit on urban roads.
15	I intend to drive within the speed limit on highways roads.
Self-reported speeding	
16	Exceed the speed limit by more than 10 km/h on urban roads?
17	Exceed the speed limit by more than 20 km/h on urban roads?
18	Exceed the speed limit by more than 10 km/h on highways?
19	Exceed the speed limit by more than 20 km/h on highways?
20	How often do you disregard the speed limit on an urban road?
21	How often do you disregard the speed limit on a highway?
22	Deliberately disregard the speed limit late at night or very early in the morning?
23	<i>Find yourself travelling above the speed limit without realising you are doing it?</i>
24	<i>Not knowing the speed limits of the road you driving?</i>

Note: All items in italics were informed from the focus discussions.

3.3 Procedure

Fleet drivers from a company involved in the production and distribution oil/petroleum products were approached to take part in the research. After accepting to take part in the study, participants were provided with information and definition of terms. Examples are “work vehicle driving: means driving in any work-related vehicle or situation; “private vehicle driving” means driving personal vehicles or any non-work related vehicle; “speed limit violation” means any occasion where you are travelling above the speed limit in either an urban area (50km/h) or on a highway (80km/h). Participants were assured of anonymity and the need for honest responses. Furthermore, drivers were assured that neither their company nor any other organisation would have access to their individual responses or on-road driving data. All data will be available only to the individual researchers involved in the study and to be used for academic purposes only.

To increase the participation rate in the study, drivers were informed of the opportunity to receive an incentive of N10,000 (ten thousand naira, the equivalent of £20) for their participation in the study. Prior ethical approval had been granted by the Research Ethics Committee of the University of Leeds with Ethics reference: AREA 16-011.

The study involved two phases of data collection which include; *subjective* (self-reporting of attitudes and behaviour; and *objective* (on-road driving). The subjective data collection phase began with questionnaires sent to a representative of the drivers who then administered them by hand to the drivers with an instruction to complete at home and return next day to the researcher. Upon return of the questionnaires, participants were given a reference number which was used to match their questionnaire and observed behavioural data.

The objective data collection phase of the study involved 20 of the participants (part of those who completed the attitudinal questionnaire) driving through a test route of 46km length. The initial choice of this route was based on the suggestion of the Federal Road Safety Corps (the agency responsible for road traffic safety in Nigeria), and was hinged on the following factors: (1) free flowing traffic conditions (2) availability of different speed limit zones and signage (3) known route with high traffic crashes and fatalities. A prior speed survey showed moderate speed limit violation by the driving population. While the route had varying speed limit sections, results are presented only for the 50km/h speed zones based on the fact that it was used in the hypothetical driving scenario in the questionnaire. Participants drove a hired Toyota Camry, 1999 model, during the test drives, and were asked to drive as they would normally in their day-to-day private (non-work) driving. The drives were done without an observer or experimenter in the car to minimise observer effects. Participants' speeding behaviour was logged on a hand-held 1hz GPS logger which was kept on top the dashboard. However, participants had no idea of what the device was or what it did. Like most on-road studies it was not possible to control for all factors and circumstances; thus, participants were asked to report to the researcher incidences of traffic congestion, adverse weather, road crashes, or any personal factor that could have prevented them from driving normally. To mitigate against these factors, all data where participants

reported incidents affecting their test drives (as stated above) were invalidated, and participants asked to re-test on a different date.

The time between return of self-report survey and completion of on-road drives varied among participants and was within the range of 1-5 weeks. Due to participants busy work/private schedules, and the need to avoid traffic, test drives could only be possible on weekends and between 8am-12 noon (low traffic volume were usually observed at this time). It was presumed that participants attitudes towards speed limit compliance do not just change overnight. There was no reason to believe that there will be any external factors or circumstances influencing participants attitudes and behaviour towards speed limit compliance between the time of completing the questionnaire and observed driving. There were no known speeding campaigns by government or their employer or anybody during this period. Hence the expectation that their attitudes were stable at the time.

4 Results and Discussion

4.1 Descriptive statistics and correlations in the TPB and Self-reported behaviour

From the analysis, results show mean scores ranging from 3.81- 4.58 on a 5.0 scale. Table 2 shows the mean scores of each TPB variable were above the midpoint indicating that overall, the participant's attitudes, subjective norm, PBC, intentions and self-reported behaviour were more favourable towards speed limit compliance. The results also show that the scores were slightly higher for driving in work vehicles than in private vehicles. There was a slight spread of the scores about the mean as can be seen from the standard deviations.

Due to the violation of normality by several of the measurement, Spearman correlation analysis was used to test the relationships among the TPB constructs. Results shows that participants' attitudes were positively and significantly correlated with their intentions in both work and private vehicles ($r=.438$; $r=.444$ respectively). Participant subjective norm was significantly and positively correlated with their intention to comply with speed limit in their work vehicle only ($r=.314$). There was no significant correlation between their PBC and intentions in either their

work or private vehicle. These results compare to some extent with those found by general analyses of the TPB on speed limit compliance (e.g Elliot et al., 2007; Tavafian et al., 2011). They are also comparable with Newnam et al. (2004) TPB study that focused specifically on drivers' intentions to speed. The Newnam et al. study found attitude to be negatively correlated with intention to speed in both work and private vehicles.

Analyses also revealed significant correlations between self-reported behaviour and TPB variables in both work and private vehicles. However, subjective norm was not significantly correlated with self-reported behaviour in private vehicles.

Table 2: Descriptive Statistics and correlations for the TPB variables and self-reported speeding behaviour

N=68														
Variable	Work Vehicle							Private Vehicle						
	A	Mean (SD)	A	SN	PBC	I	B	α	Mean (SD)	A	SN	PBC	I	B
Attitude	.68	4.32 (0.51)	1.00	-.009	.097	.438*	.101**	.68	4.08 (0.57)	1.00	.086	-.251**	.444*	.493*
Subjective Norm	.90	3.81 (0.97)	-.009	1.00	.526*	.314*	.390*	.87	3.27 (1.05)	.086	1.00	.086	.144	.011
PBC	.81	3.81 (1.01)	.097	.526*	1.00	.150	.460*	.75	3.51 (1.00)	-.251**	.086	1.00	-.030	-.283**
Intention	.93	4.58 (0.76)	.438*	.314*	.150	1.00	.260**	.98	4.03 (1.23)	.444*	.144	-.030	1.00	.423*
Self-reported behaviour	.74	4.57 (0.53)	.101	.390*	.460*	.260**	1.00	.90	3.26 (0.95)	.493*	.011	-.283 ^b	.423*	1.00

Note: A high mean value indicates attitude, subjective norm, PBC and intention in favour of complying with the speed limit.

A high score for self-reported behaviour (B) indicates high levels of compliance with speed limit.

*= Correlation is significant at the 0.01 level (2-tailed) (p <.01)

**= Correlation is significant at the 0.05 level (2-tailed) (p <.05)

4.2 Predicting intention to comply with the speed limit

A multiple regression analysis was carried out for the subjective data to determine how much variation of drivers' intention to comply with the speed limit is explained by their attitude, subjective norm and PBC. The regression analysis was also used to identify the predictors of drivers' self-reported behaviour.

Figure 1 shows the TPB significantly predicted 12.1% of the variance in drivers' intention to comply with speed limit in their work vehicles ($F(3, 64) = 2.95, p = 0.039, (p < 0.05)$) and 24% of the variance in their private vehicles ($F(3, 64) = 6.58, p = 0.001, (p < 0.01)$). However, the largest and only significant prediction of intention was explained by their attitude $\beta = .331, p = 0.007 (p < 0.01)$ and $\beta = .50, p = 0.0005 (p < 0.01)$ respectively for work and private setting. This means that drivers with a positive attitude towards speed limit compliance were more likely to have the intention to perform the behaviour in both their work and private vehicles. The results are partly comparable with several studies that have demonstrated the ability of the TPB to predict intention to comply with speed limits (Elliott et al., 2004; Elliott et al., 2007; Abdul, 2014). Also, in spite of the difference in the dependent variable of the current study (compliance with speed limit) and other studies that focus on exceeding the speed limit (Parker et al., 1992; Stead et al., 2005; Newnam et al., 2004), the findings are broadly similar.

However, subjective norms and PBC did not significantly contribute to the prediction of intention. These findings are not uncommon as past studies by Abdu (2014), Armitage and Conner (2001) have also identified subjective norm to be relatively weak in the prediction of intention (relative to attitude and PBC). A potential explanation for this weakness could be that having the support of important others to comply with speed limit would not necessarily lead to forming the intentions to do so. This is supported by Rivas and Sheeran (2003) who argue that subjective norm may not entirely capture all the potential normative influences which may be impacting upon an individual, as it focuses only on what the individual thinks their important others approve or disapprove. Another possible reason for the poor prediction of intention by drivers' subjective norm is that drivers are inclined to make decisions from an individualistic perspective, rather than group responsibility (Hanan, 2014). Also, there have been arguments on the need to expand the construct to capture both *injunctive norms* (social pressure on drivers to perform or not to perform from other road users including vulnerable road users and other drivers) (Haglund & Åberg, 2000), and *descriptive norms* (pressures to imitate other road users or perception of what is commonly done by others) (Haglund & Åberg, 2000; Pelsmacker & Janssens, 2007).

According to Armitage and Conner (2001, p.472), in situations where attitudes are strong, PBC may be less predictive of intentions. Results from the current study show that participants held strong attitudes towards speed limit compliance, thus a possible explanation for the poor contribution of PBC in predicting intention.

4.3 Predicting Self-Reported speed limit compliance behaviour

Self-reported behaviour was regressed on intention and perceived behavioural control. Together these variables accounted for 44% of the variance in self-reported behaviour in private vehicles ($R^2 = .440$, $F(2, 65) = 25.513$, $p = 0.0005$, $p < 0.01$), and both were significant independent predictors ($\beta = .620$, $p = 0.0005$, $p < 0.01$; and $\beta = -.193$, $p = 0.042$, $p < 0.05$ respectively). These results compare favourably with those found by Elliott et al. (2004) and Abdul Hanan (2014). In contrast, there was no significant prediction of the behaviour by either intention or PBC in work vehicles ($R^2 = .081$, $F(2, 65) = 2.848$, $p = 0.065$). A possible reason for the poor prediction of self-reported behaviour in work setting could be that the TPB is better operationalised in a private setting than a work setting (Newnan et al 2004). This may be related to the fact that the driver's may have a higher degree of freedom in expressing their held beliefs and behaviour in a private setting than a work setting.

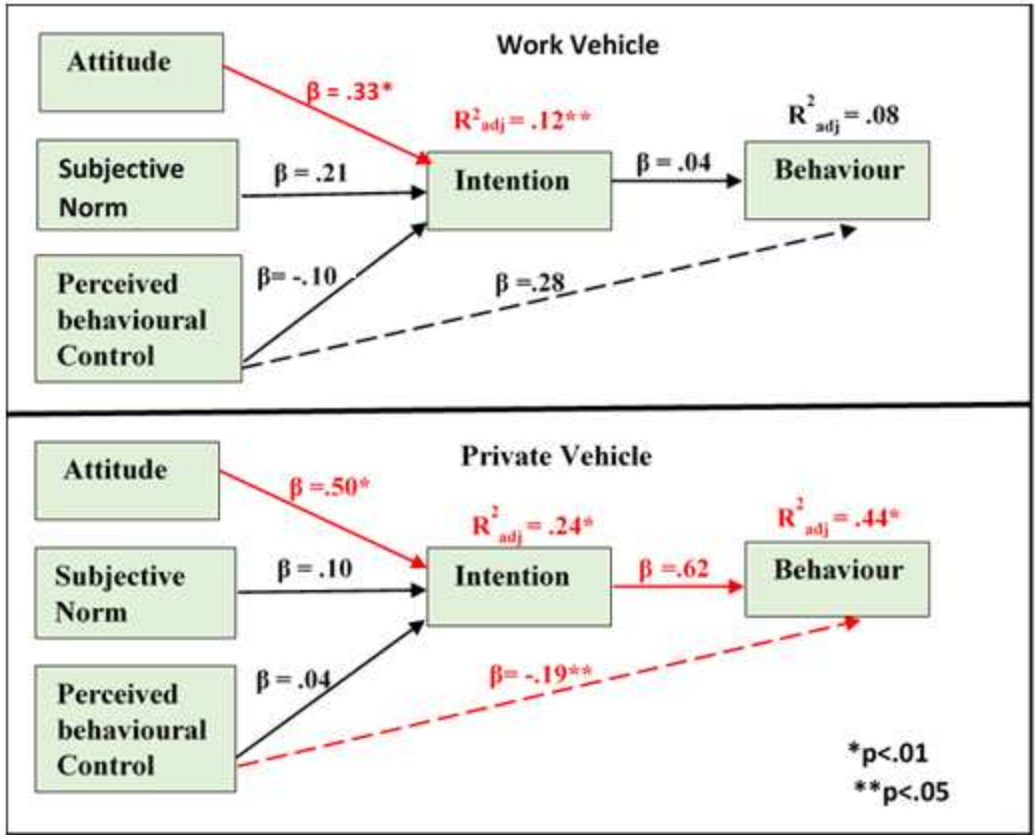


Figure 1: Path analysis of the TPB factors and their prediction of intention and behaviour with regards to compliance with speed limits.

4.4 Comparing TPB Constructs in Work and Private Settings

Due to non-normality of several of the measurements, the non-parametric Wilcoxon sign rank test was used to compare the TPB constructs between work and private settings at a significance level of $\alpha = 0.05$. Results show that participants were relatively more likely to have favourable attitudes towards speed limit compliance ($z = 2.756, p=0.006$), more support from important others ($z = 3.618, p=0.0005$), perceived greater control of their behaviour ($z = 2.272, p = 0.023$), had stronger intentions to comply with speed limits ($z = 3.308, p = 0.001$) and self-reported more compliance to speed limits ($z = 6.451, p = 0.0005$) in a work vehicle than in a private vehicle (see Table 3).

Although the current study investigated compliance with speed limit, the results, comparatively differ slightly from those of Newnan et al. (2004) who found only intention to speed and

subjective norm to be significantly more favourable in work vehicles than private vehicles. One possible explanation for this difference in findings is the use of only drivers who work in a company with a strong safety culture in this study, compared with the Newnam et al. study which involved drivers from organisations with extensive and less extensive safety regimes. It also seems reasonable to assume that, due to the difference in context (participants in the study are from a LMIC country) and the nature of the study in promoting speed limit compliance (a behaviour that is highly favoured by their company safety policies), participants in this study were more likely to portray themselves in a good light in work vehicles than in private vehicles.

Table 3: Statistical analysis of the TPB constructs in work and private vehicles

Variables	Median		Paired differences
	Work	Private	
Attitude	4.37	4.13	Z (67) = 2.756; p= 0.006, p<0.01
Subjective Norm	4.00	3.50	Z (67) = 3.618; p= 0.0005, p<0.01
Perceived Behavioural Control	4.00	3.33	Z (67) = 2.272; p= 0.023, p<0.05
Intention	5.00	4.75	Z (67) = 3.308; p= 0.001, p<0.01
Self-reported Behaviour	4.78	3.44	Z (67) = 6.451; p= 0.0005, p<0.01

Note: A high median value indicates attitude, subjective norm, PBC and intention in favour of complying with the speed limit. A high score for self-reported behaviour indicates high levels of compliance with speed limit. Correlation is significant at the 0.05 level (2-tailed) (p < .05)

4.5 The relationship between TPB variables and objectively measured speeding behaviour in private settings

The current study seeks to examine the association between objectively measured speeding behaviour obtained by means of GPS logged data from on-road driving, and TPB variables (obtained from the self-reported questionnaire) in a private vehicle (drivers' speeding behaviour could not objectively be measured in their work vehicles due to their company restrictions). To select a measure that is closely matched to the TPB measures, the speeding behaviour is defined

as the percentage distance spent driving at 1km/h or more above the speed limit (PDAS) in the 50km/h speed zone. The 50 km/h speed limit is selected because it was used in the hypothetical driving scenario in the questionnaire.

Table 4: Observed PDAS for all speed zones

Speed Zone	PDAS (%)
50	65.1
60	83.01
80	14.9

Table 4 present results for all speed zones. The results show speed limit violation was prevalent across all speed zones, with the lowest levels of compliance observed in the 60 km/h zone where participants drove in excess of the speed limit for 83% of the drive. Compliance with the speed limit was greatest on the 80km/h speed zone where participants drove in excess of the speed limit for about 15% of the drive on average. The data reported in this paper were collected as part of a larger study on the use of an advisory intelligent speed assistance (ISA). Only data relevant to the reported analysis are discussed.

Table 5: Median, Standard Deviation and Correlation Coefficients of TPB variables with objectively measured speeding behaviour at 50km/h speed zone

S/N	Variable	Median	SD	PDAS (%)
1	Intention	5.0	0.7	-0.655*
2	PBC	3.33	0.9	-0.495*
3	Attitudes	4.37	0.6	-0.368
4	Subjective Norm	4.0	4	-0.258
5	PDAS (%)	65.1	7.9	1.0

Note: A high median value indicates attitudes, subjective norm, PBC and intention in favour of complying with the speed limit

*= Correlation is significant at the 0.01 level (2-tailed) ($p < .01$)

**= Correlation is significant at the 0.05 level (2-tailed) ($p < .05$)

Table 5 shows descriptive statistics and Spearman correlations in the TPB variables with observed behaviour. A high median score value indicating the TPB variable in favour of complying with

speed limits. Analysis shows that drivers demonstrated high levels of intention, attitudes and subjective norm with regards to speed choice; however, their median PBC levels were just slightly favourable. The median percentage distance travelled at 1km/h or more above the speed limit was 65.1%. Results showed all TPB variables to be negatively correlated with the percentage distance spent driving at 1km/h or more above the speed limit. However, intentions ($r = -0.655$, $p = 0.002$) and PBC ($r = -0.495$, $p = 0.026$) appeared to be the strongest and only statistically significant correlations with the objectively measured behaviour. The negative correlations coefficients for intention and PBC indicate that participants with higher intention to comply with the speed limit or higher perceived behavioral control, exceeded the speed limit less often than those with lower intention to comply with the speed limit or lower perceived behavioral control. These findings are very similar those of Elliot et al. (2007) who also found intention and PBC to be negatively correlated with observed speeding behavior.

Table 6: Difference in percentage distance travelled at 1km/h or more above the speed limit (PDAS) on 50km/h speed zone to median split of TPB variables

Intention						
	Low intention (N=7)		High intention (N=13)		Median Diff	Paired differences
	Median	SD	Median	SD		
PDAS (%)	70.9	4.6	62.3	7.9	8.58	U = 10, z = -2.813, p = 0.003, **
PBC						
	Weak PBC (N= 6)		Strong PBC (N=14)		Median Diff	Paired differences
	Median	SD	Median	SD		
PDAS (%)	70.1	5.4	62.6	8.1	7.5	U = 19, z = -1.897, p = 0.062, NS
Attitudes						
	Less positive attitudes (N= 8)		More positive attitudes (N= 12)		Median Diff	Paired differences
	Median	SD	Median	SD		

PDAS (%)	68.3	10.4	62.6	6.2	5.7	U = 32, z = -1.234, p = 0.238, NS
Subjective Norm (SN)						
	Weak SN (N= 8)		Strong SN (N=12)		Median Diff	Paired differences
	Median	SD	Median	SD		
PDAS (%)	69.3	9.6	62.6	6.9	6.7	U = 33, z = -1.157, p = 0.270, NS

Note: A high median value indicates attitudes, subjective norm, PBC and intention in favour of complying with the speed limit
Correlation is significant at the 0.05 level (2-tailed) ($p < .05$)
NS = Not significant

Ideally, the relationship between the TPB variables and the objectively measured speeding behaviour would be done using a regression analysis as done in past studies (Conner et al., 2007; Elliot et al., 2007). However, due to the small sample size used in this study (only 20 participants completed the on-road part of the study), the sufficiency power for a regression is not met. Instead, a median split of the TPB variables was performed in order to create a dichotomous variable to compare differences in TPB constructs with the dependent variable being the percentage distance travelled at 1km/h or more above the speed limit. Spearman correlation (due to the non-normality of the data) was used to examine associations between objectively measured speeding behaviour and TPB constructs while a Mann-Whitney U-test (which is the non-parametric equivalent to independent-samples t-test) was used to examine group differences.

Table 6 presents results from a Mann-Whitney U test used to determine if there were differences in percentage distance travelled at 1km/h or more above the speed limit (PDAS) between the following types of drivers:

- a. Low and high intenders complying with the speed limit
- b. Weak and strong PBC
- c. Less and more positive attitudes
- d. Weak and strong support from significant other

The findings showed that median PDAS was statistically significantly higher for low intenders (70.8%) than for high intenders (62.3%), $U=10$, $z=-2.813$, $p=0.003$. This suggests that, even though participants generally showed high intentions to comply with speed limits, compared with low intenders, high intenders were likely to drive for longer distance without exceeding the speed limits. However, there was no other statistically significant effect on median PDAS for the other TPB variables analysed, that were potentially meaningful.

The high percentage distance spent driving at 1km/h or more above the 50km/h speed limit (65%) in the current study may be related to the concept of "*intention-behaviour gap*" which according to Elliot and Armitage (2009) relates to the gap between what drivers intend to do, and what they actually do. Sheeran (2002), postulates that the gap is caused by two groups: "Inclined Abstainers" (example drivers with positive intention but who fail to act), and "Disinclined Actors" (example drivers who comply with speed limits despite their negative intention to do so). The participants in this study may fit into the former, as they held positive intentions which were not completely translated into behaviour as seen in their high percentage distance travelled at 1km/h or more above the 50km/h speed limit in their private vehicles. Elliot et al. (2003) conclude that the reason why positive intention of most drivers to speed limit compliance is not always translated to the target behaviour is that speeding is habitual, and habits tend to interfere with the process of translating motivation to action. This is supported by Musselwhite et al. (2010) who argue that regardless of whether a person intends to drive in a safe manner or does not intend to, habitual processes (automatic or mindless processes developed out of frequent experience with the environment and occur without fore thoughts or conscious information processing) tend to supersede cognitive processing (systematic appraisal of information before acting).

PBC showed a significant negative correlation with observed behaviour, but no significant differences between drivers with weak and strong perceived control of their speed choice. Though not significant, the size of the p values = 0.062 shows that the finding may be meaningful.

Finally, it is not surprising that drivers' attitudes and subjective norm did not have any statistical significance in terms of either correlations or differences between the dichotomous groups with

the objectively measured speeding behaviour. According to the TPB, both variables can only predict behaviour through intention and not directly.

5 Conclusions

Using the Theory of Planned Behaviour (TPB), this paper investigated the socio-cognitive determinants of speeding behaviour of drivers who work in a company with strong safety culture in their work and personal vehicles. It also sought to understand the relationship between TPB variables and objectively measured speeding behaviour. A few theoretical and practical implications have emerged from the study for organizational and road safety policies implementation. A key finding from the study is the identification of attitudes towards speed limit compliance as the main predictor of drivers' intentions to comply with speed limits in both work and private vehicles. This could serve as a tool in developing future interventions in this context. It can be recommended that behavioural interventions aimed at reducing speed limit violation among Nigerian drivers should target their attitudes (drivers' positive or negative evaluation to performing the behaviour). For instance, campaigns strengthening positive beliefs and confirming the consequences of speeding can provide useful and stable bases for interventions. Persuasive strategies, such as highlighting the losses in terms of grief and properties affecting other road users and children, can help translate their held beliefs into favourable behaviour.

Also, as suggested in the present study, the TPB was better at predicting drivers' intentions to comply and self-reported behaviour in private than work vehicles. According to Newnam et al. (2004), it is quite possible that the TPB is better operationalised in the private-setting than in a work setting, which can be further explained with the adaptation of the TPB measures from past studies examining general driving, therefore increasing its utility in prediction in the private vehicles.

One key finding from this study is that the organisational guidance on safety culture does not necessarily influence employees' personal beliefs and behaviour. Anecdotal evidence suggests that companies with a strong safety culture keep a "lid" on drivers expressing their true attitudes even if they might have them. Driving for such companies do not automatically change held

beliefs and habits, but only suppresses them when at work with drivers being free to express this beliefs and habits in non-work settings. Drivers have more degree of freedom in their private driving than in work driving, as in the former there is no anticipated fear of losing their jobs. Thus, it is very likely for a driver to have negative attitudes that cannot be expressed in a work vehicle, as there is more control in this setting than in the private driving. Clearly, this is an important distinction to understand because these elevated propensities for risk-taking in private settings suggest very different intervention strategies in a non-work setting. Thus, it is important to establish how organisations can bring the work and private attitudes of their employees together. Possible interventions may include options for organisations to internalise speed limit compliance messages and training for drivers, rather than emphasising too much on work safety. For instance, organisational speed limit compliance campaigns should be designed to encourage reinforcement of speed limit compliance as ‘the right thing to do’. Companies should encourage their drivers to imbibe safety as a way of life through continuous support, and provide rewards for compliance, rather than putting employees under undue pressures.

This study was able to examine the relationship between drivers’ objectively measured speeding behaviour in their private vehicles and their TPB variables. Although the sample size of the data was not sufficient in the prediction of the relationship using the logistical model, correlation analyses suggested that drivers’ intention and PBC were negatively associated with their observed behaviour. Also, the median split of the TPB variables revealed that compared with low intenders, high intenders were likely to drive for longer distance without exceeding the speed limits.

In conclusion, though small, the sample size for the current study appears to reflect the underlying fleet driver’s population with regards to working in a company with strong safety culture and ownership of a private car in Nigeria. It is important to treat these results with some level of caution as it is not possible to generalise the findings to the wider population of drivers who work for fleet companies with strong safety culture. Future research should attempt to involve organisations that do not have strong safety culture for their drivers (e.g. companies that deal with less hazardous or expensive materials). Such a study will not only provide more insights

regarding the differences in attitudes and behaviour between organisations with strong and those with lenient safety cultures but would also help to explain the variance in the behaviour of drivers in the work and private settings.

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