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Pedestrian safety: Motorists' attitudes to the law and driving practices in South Africa

In Africa, 40% of traffic fatalities are pedestrians – the highest proportion globally. Yet little is known about driver characteristics that are associated with unsafe driving in African countries. We aimed to explore associations between driving practices that endanger pedestrian safety and motorists' attitudes to the law (i.e. lawlessness and normlessness), controlling for sociodemographic and personality factors. We used the Response Time Method, based on Russell Fazio's attitude paradigm, to collect information about driver behaviours, attitudes, and personality traits among a sample of 440 motorists. Male gender was associated with unsafe driving, even when controlling for the effects of personality and attitudes to the law. Unsafe driving was also associated with four dimensions of motorists' personality, namely aggression, impulsivity, risk tolerance, and altruism, even when controlling for sociodemographic factors. Lawlessness (defined as a general disregard for the law) is also an important determinant of unsafe driving, even when controlling for sociodemographic and personality factors. These findings suggest that efforts to improve pedestrian safety in South Africa should focus on changing motorists' attitudes to the law.

Significance:

This study addresses pedestrian safety in the context of South Africa. The fact that 40% of traffic fatalities are pedestrians highlights the urgent need to understand the factors contributing to unsafe driving practices. The study delves into uncharted territory by examining driver characteristics associated with unsafe driving. Through exploring associations between driving practices that endanger pedestrian safety and motorists' attitudes to the law, this article provides valuable insights that can inform targeted interventions.

Introduction

Globally, road traffic crashes account for approximately 1.35 million deaths annually, and up to 93% of these occur in low- and middle-income countries (LMICs).[1] Furthermore, 23% of all traffic fatalities are pedestrians, with the figure increasing to 40% in Africa – the highest proportion globally.[2] The high rates of pedestrian deaths in Africa are in part a function of unsafe roads and pedestrian walkways and the high reliance on walking as a primary means of mobility in the region. Pedestrians are vulnerable to mortality and morbidity because they are directly exposed to traffic with little to protect them in the event of a collision. The World Health Organization (WHO)[2] estimates that, globally, 88% of pedestrians traverse unsafe roads, which contributes directly to pedestrian injury and death. Aside from being a significant public health issue, improving the safety of pedestrians is also a social justice issue, given that social status and income are major determinants of pedestrian injuries and deaths.[2] Promoting pedestrian safety is also essential from an environmental perspective, because campaigns to slow climate change by reducing vehicle emissions and encouraging walking will be feasible only if roads are more hospitable to pedestrians.[3,4]

Road safety is a complex, multi-faceted issue; nonetheless, road user behaviours, such as violating traffic laws, remain one of the most significant determinants of pedestrian safety.[5,6] Despite the clear contribution of driver behaviour to pedestrian safety, this aspect of transportation safety remains under-researched, especially in LMICs.[5,6] Personality factors and personal attitudes are key determinants of driver behaviour and are an important focus of study, especially given that driver attitudes are potentially modifiable factors. Motorists' attitudes towards the rule of law and the officials tasked with enforcing these laws may also be an important determinant of driver safety, particularly in countries like South Africa, where many motorists act with impunity and disregard for the law.[7] Within this context, we investigated associations between driving practices that endanger pedestrian safety and motorists' attitudes to the law in South Africa, controlling for sociodemographic and personality factors.

South Africa, a middle-income country, has some of the poorest road safety outcomes in Africa despite having a comprehensive set of traffic laws by global standards.[8] Jaywalking and speeding are the primary cause of death on South African roads, collectively accounting for 56.44% of traffic-associated fatalities.[9] Pedestrian fatalities, which account for 38% of all traffic-related deaths in South Africa, are related to the lack of pedestrian-orientated infrastructure, inadequate public transport, and a large number of informal settlements adjacent to busy roads in urban areas.[10] Enforcing traffic laws in South Africa is an ongoing challenge, partly because of widespread disregard for the rule of law and many citizens' perception of the illegitimacy of law enforcement officials.[7,11] Understanding how attitudes towards the law influence safe driving could have important implications for improving pedestrian safety in South Africa.

It is well established that road safety behaviours are a function of sociodemographic and personal factors such as income, age, gender, inattentiveness, lack of concentration, driving under the influence of either alcohol or drugs, risk-taking behaviour, and not having a licence.[12] The risk of a driver colliding with a pedestrian increases for both younger and much older drivers.[13] In high-income countries, young drivers from wealthy households are more likely to speed and violate the speed limit compared to drivers of the same age from low-income homes[12], suggesting an interaction between speeding and sociodemographic factors. Although there is a large body of evidence suggesting that men are more prone to unsafe driving than women[14,15], for instance, the WHO argues that about three-quarters of all road traffic deaths occur among young male individuals under the age of 25 years, and in Africa in particular, nearly twice as many male individuals aged 15–59 die from injury-related causes (road traffic accidents, violence, and others) than those who die from tuberculosis (20% vs 10%). Some scholars have contested this figure, as their findings

indicate no significant gender differences, especially when controlling for other confounding factors.[12,13] Frequent exposure to media representations of unsafe driving, such as playing computer games that entail speeding or watching high-speed driving in action movies, has also been shown to have an adverse effect on driving behaviour.[12,16] As might be expected, drivers who do not have valid licences are more likely to exhibit unsafe driving than licensed drivers. Indeed, unlicensed drivers are 173% more likely to cause a collision with a pedestrian than a driver with a licence.[13]

Driving styles are partly determined by personality traits, namely aggression, risk-taking, impulsivity and altruism. Drivers who score high on personality tests of aggression are more likely to have a history of traffic crashes than those who score lower[17], and are less inclined to yield for pedestrians.[15] Motorists also exhibit a pronounced tendency to justify their own unsafe driving behaviours by asserting that they were provoked by other aggressive motorists.[17,18] Drivers who report high levels of trait aggression are more inclined than other drivers to feel irritated by pedestrian jaywalkers and fail to give way to them.[19] Risk tolerance (i.e. the opposite of risk aversion) is also strongly associated with unsafe driving behaviours and low levels of empathy for other road users.[14,20,21]

Unsafe driving is also positively correlated with trait impulsivity (i.e. the dimension of personality that measures an individual's tendency to act impulsively and have difficulty inhibiting behaviour).[22,23] One systematic review of associations between impulsivity and driving styles concluded that trait impulsivity is also associated with motorists' tendency to express anger, drive aggressively, speed, and violate traffic laws.[23] Indeed, promoting motorists' impulse control and their ability to regulate anger are important strategies for curbing unsafe driving, particularly among young drivers.[22–24] Impulsivity is also associated with poor self-control and an inability to anticipate consequences, which increase motorists' propensity to drink and drive, a leading cause of vehicle collisions with pedestrians.[13,23] Altruistic traits (i.e. a person's tendency to show concern for others' well-being, being cooperative and kind-hearted) are negatively correlated with deviant and dangerous driving behaviours.[12,25,26]

Some scholars have noted that personality traits are generally weak predictors of unsafe driving, suggesting that adherence to social norms and morality play a more significant role in shaping driving styles.[6,27] Indeed, motorists appear more willing to yield for children and elderly pedestrians, suggesting that driving behaviour is related to motorists' perceptions of morality and social norms. Hashemiparast et al.[28] found that normative beliefs of non-compliance contributed to lawlessness. Acemoglu and Jackson[29] suggest that this occurs because numerous individuals are disobeying the law, leading each individual to expect minimal whistleblowing, resulting in lawlessness. Robinson[30] postulates that social forces (norms of justice) are internalised by group members, essentially regulating their behaviour and thus promoting social cooperation (irrespective of whether the cooperation payoff is known or unknown). Sinclair[31] refers to this phenomenon in South Africa, where people who believe themselves to be law-abiding become part of the majority group that does not adhere to formal rules. Acemoglu and Jackson raise a related point by showing that unreasonably severe laws may, in some instances, encourage society to transgress.[29] Jovanović et al.[32] compared drivers in Serbia to those in Northern Kosovo. Their results show that a lack of enforcement affects almost every other type of behaviour (speeding, the wearing of seat belts, driving under the influence, as well as ordinary violations that involve risky behaviour).

Furthermore, unsafe driving behaviour has consistently been associated with both normlessness (i.e. a state in which social norms have been eroded)[6,33,34] and lawlessness (i.e. disregard for the law)[12,34]. Understanding how attitudes towards the law influence driving styles could have policy implications for improving pedestrian safety, especially in countries like South Africa, where high rates of criminality may create permissive social norms.[31]

Methods

Our aim was to explore associations between driving practices that endanger pedestrian safety and motorists' attitudes to the law (i.e. lawlessness and normlessness), controlling for sociodemographic and personality factors among a sample of postgraduate students and staff members (including academic, support and administrative staff) from a university in the Western Cape, South Africa. We used the Response Time Method (RTM), based on Russell Fazio's attitude paradigm[35], to collect information about driver behaviours, attitudes, and personality traits. This method helps overcome the limitations of commonly used self-report survey methods that are prone to social desirability bias. In effect, the RTM measures the instinctive reactions of respondents while minimising the influence of cognitive biases and distortions that typically occur in traditional explicit measures such as self-report surveys. The method has mostly been used in the field of marketing, where the measurement of attitudes is important to predict future sales.[36] The RTM minimises the biases typical of declarative questionnaires, such as social pressure or the so-called 'sponsor effect', because it assesses the level of hesitation when providing a given answer. The strong values are expressed with high confidence and indicated by faster response times, whereas slower response times indicate weaker, less accessible attitudes expressed with hesitation. This approach assesses both the response time and the declarative answer, thus supplying both implicit and explicit data. These two scores are merged into a single number by multiplying the declarative with the response time score, which results in a confidence index. This confidence index provides a measure of how honest a participant has been in their response.

Ethical consideration

The study received ethical clearance from the Research Ethics Committee for Social, Behavioural and Education Research (Stellenbosch University). We also obtained institutional permission from Stellenbosch University (Project number: 16765). Participants provided informed consent electronically prior to data collection. All data were collected anonymously and were securely stored on a password-protected web-based server.

Sample

Emails were sent to all postgraduate students and all administrative, academic and support staff of Stellenbosch University. Half of the emails were linked to the test for drivers and the other half to the test for pedestrians. These were distributed evenly between staff and postgraduate students. The demographic questions we asked related to age, gender, level of education, employment status, and annual family income. The self-selected sample of participants ($n = 440$) consisted predominantly of individuals self-identifying as female (58.3%), employed individuals (54.5%), and individuals with a tertiary level of education (92.0%). Only a few individuals did not possess a university degree. From this, we can infer that slightly more than half of the sample were staff, and the rest were students. Participation was incentivised through a lucky draw that offered five participants each a ZAR500 gift voucher to an online shop.

Procedure

Participants were invited via email to complete an online response time survey using the iCode platform. Informed consent was obtained electronically prior to data collection. The online assessment took 10 minutes to complete and consisted of three parts: (1) collection of sociodemographic information (age, gender, level of education, employment status and annual family income); (2) a calibration phase in which respondents were familiarised with how the survey worked and asked to complete a series of tasks that assessed whether they could read and follow instructions and understand which buttons to press to respond to survey items; and (3) the survey phase in which a set of 50 statements were presented one-by-one in a randomised order.

Measures

We used the iCode platform to present participants with statements and asked them to indicate whether they agreed or disagreed with each statement. We measured participants' response time and the resultant confidence index for each of the statements. At the start of the survey, participants were presented with a series of 'warm-up' statements that were used for individual calibration (i.e. to create a personal baseline which took into account individual differences, such as familiarity with computers, age, fatigue, length of statements, speed, and stability of Internet connection and (in)voluntary carelessness of respondents). The survey statements are indicated in the Appendix.

Unsafe driving practices

Participants were asked to agree or disagree with seven statements that assessed unsafe driving and practices that endanger pedestrians. Participants' responses to these items were aggregated to yield an 'unsafe driving index' (a value from 0 to 7, with higher scores indicating unsafe driving that endangers pedestrians).

Personality

Participants were asked to agree or disagree with 35 statements assessing four dimensions of personality, namely aggression, altruism, impulsivity, and risk avoidance. We assessed impulsivity with the brief eight-item version of the Barratt Impulsiveness Scale.[37]. To assess aggression we used the eight-item Aggressive Beliefs and Attitudes Scale.[38] To assess normlessness we used statements derived from Kohn and Schooler's normlessness scale[39], which has been used in previous studies of driver behaviour[40,41]. We assessed risk aversion and risk perception with nine items adapted from the Perceived Risk of Risky Driving Behaviours Scale, which has been used in other studies of road safety and driver behaviour.[42,43] Finally, to assess altruism, we used the items from the Altruism Subscales of the International Personality Item Pool (IPIP).[44]

Attitudes to the law

Participants were asked to agree or disagree with eight statements assessing lawlessness (i.e. a general disregard for the law) and five statements assessing normlessness (i.e. a breakdown of social norms regulating individual conduct). We derived these statements ourselves, based on our previous qualitative and quantitative research in this area.

Data analysis

Data were cleaned and checked, and the statistical program STATA was used for the analysis. Descriptive statistics were used to provide a description of the sample characteristics. In the first step of the analysis, we calculated Cronbach's alpha to assess the internal consistency of the items included for each dimension of personality and for the subset of statements assessing attitudes to the law. Subsequently, we used simple and multiple regression analyses to identify associations between unsafe driving and sociodemographic variables, personality variables and attitudes to the law. Second, we used multivariate regression to explore associations between lawlessness and unsafe driving, controlling for sociodemographic and personality factors identified as significant in the preceding analysis. In the final step of the analysis, we estimated a multivariate regression model of factors associated with unsafe driving, including only the variables that were significant in the preceding model. The results of all regression analyses are presented as beta coefficients (with associated 95% confidence intervals). For all analyses, the level of significance (alpha) was set as 0.05.

Results

The sample consisted predominantly of individuals self-identifying as female (58.3%), employed individuals (54.5%), and individuals with a tertiary level of education (92.0%). The estimated mean score of the unsafe driving index is 3.1±0.07 (s.d.=1.5, range=0–7).

Sociodemographic factors associated with unsafe driving

In the first step of the analysis, we used simple and multiple regression analysis to identify sociodemographic factors associated with unsafe driving practices (Table 1). The sociodemographic factors are categorical variables (which include education, gender, income, age, and employment status). In the bivariate analysis, unsafe driving was positively associated with male gender (β=0.5, p<0.001) but not with any of the other sociodemographic variables. In the multivariate analysis, controlling for the effects of all sociodemographic variables, unsafe driving was positively associated with male gender (β=0.6, p<0.001) and inversely associated with higher levels of education (β= -0.6, p<0.005).

Personality factors

We calculated Cronbach's alpha for the set of statements in each dimension of personality assessed (i.e. aggression, altruism, impulsivity, and risk aversion) to assess the internal consistency of each construct. The poor internal consistency of the items in each dimension indicated that the included questions were not measuring the same thing, suggesting that each item assessed a different component of the underlying dimension of personality. Consequently, rather than considering all statements for each dimension collectively, we instead considered each statement individually within each personality dimension. Simple and multiple regression analyses were used to explore associations between driving practices that endanger pedestrians and each statement within each of the four dimensions of motorists' personality (Table 2). For each personality dimension, we identified the best-fitting combination of statements associated with unsafe driving. In terms of aggression, unsafe driving was associated with "I sound my horn to indicate my annoyance to another road user" (β=0.4, p<0.05) and "Sometimes passengers tell me to calm down because I am angry at other drivers" (β=0.4, p<0.05), and "Some people are just bad people" (β=0.5, p<0.05). For altruism, unsafe driving was associated with the statement "I look down on others" (β=0.5, p<0.01) and for impulsivity, unsafe driving was inversely associated with "I am a careful thinker" (β=-0.3, p<0.05) and "I concentrate easily" (β=-0.5, p<0.01). Unsafe driving was also associated with risk-taking ("I drive a vehicle while feeling tired or fatigued"; β=0.5, p<0.01).

Attitudes to the law

Simple and multiple regression analyses were used to explore associations between driving practices that endanger pedestrians and attitudes to the law, namely lawlessness (i.e. a general disregard for the law) and normlessness (i.e. a breakdown of social norms regulating individual conduct). The link between social norms and people's attitudes to the law (including institutions of the state responsible for enforcing these laws), implies that simply changing the laws and/or increasing the penalties for transgressions is unlikely to make roads safer if people's attitudes to the laws are not also addressed.

As seen in Table 3, unsafe driving was associated with endorsing the following statements reflecting lawlessness: "I claim government benefits to which I am not entitled" (β=0.7, p<0.01); "I make illegal U-turns at intersections" (β=0.4, p<0.01); "I sometimes accept bribes in the course of my duties" (β=0.4, p<0.05); "I sometimes

Table 1: Sociodemographic factors associated with unsafe driving practices

	Univariate analysis		Multivariate analysis	
	Beta	**95% Confidence interval**	**Beta**	**95% Confidence interval**
Education	-0.4	-1.0–0.2	-0.6**	-1.2–0.1
Age	0.0	-0.1–0.2	0.1	-0.0–0.3
Male gender	0.5***	0.2–0.8	0.6***	0.3–0.9
Income	-0.0	-0.0–0.0	-0.0	-0.0–0.0
Employment status	-0.1	-0.4–0.2	-0.2	-0.6–0.2

****p<0.01, **p<0.05*

Table 2: Motorists' personality factors associated with unsafe driving practices

		Univariate analysis		Multivariate analysis	
		Beta	**95% Confidence interval**	**Beta**	**95% Confidence interval**
Aggression	"Getting back at others makes me feel better"	0.1	-0.2–0.4	0.1	-0.2–0.4
	"I feel the need to get even if someone disrespects me"	-0.0	-0.3–0.2	-0.2	-0.5–0.2
	"I have the right to retaliate if I am betrayed"	0.2	-0.1–0.5	0.1	-0.2–0.4
	"I sound my horn to indicate my annoyance to another road user"	0.4**	0.1–0.7	0.4**	0.0–0.7
	"Large corporations exploit their employees"	-0.0	-0.4–0.3	-0.2	-0.5–0.2
	"Some people are just bad people"	0.6***	-1.0–0.3	0.5**	-1.0–0.1
	"Some people are simply horrible human beings"	-0.3	-0.6–0.1	-0.2	-0.6–0.2
	"Sometimes passengers tell me to calm down because I am angry at other drivers"	0.5***	0.2–0.8	0.4**	0.0–0.7
	"The rich get richer by taking advantage of the poor"	0.2	-0.2–0.5	0.1	-0.3–0.5
	"The wealthy capitalise on those who are less fortunate"	0.1	-0.3–0.4	0.2	-0.3–0.6
Altruism	"I am concerned about others"	-0.2	-0.5–0.2	-0.1	-0.4–0.3
	"I am indifferent to the feelings of others"	0.0	-0.3–0.3	0.0	-0.3–0.3
	"I anticipate the needs of others"	-0.0	-0.3–0.3	-0.0	-0.3–0.3
	"I have a good word for everyone"	-0.1	-0.4–0.3	0.1	-0.2–0.4
	"I look down on others"	0.6***	-0.9–0.4	0.5***	-0.8–0.2
	"I love to help others"	-0.4***	-0.7–0.1	-0.2	-0.5–0.1
	"I make people feel uncomfortable"	-0.1	-0.4–0.2	-0.0	-0.3–0.3
	"I make people feel welcome"	-0.1	-0.4–0.2	-0.0	-0.4–0.3
	"I make time for others"	-0.4***	-0.7–-0.2	-0.3	-0.5–0.0
	"I turn my back on others"	-0.3**	-0.6–0.1	-0.1	-0.4–0.2
Impulsivity	"I act on the spur of the moment"	0.1	-0.2–0.4	0.1	-0.2–0.3
	"I am a careful thinker"	-0.4***	-0.7–0.2	-0.3**	-0.6–0.0
	"I am self-controlled"	-0.2	-0.5–0.1	0.0	-0.3–0.3
	"I concentrate easily"	-0.6***	-0.9–0.3	-0.5***	-0.8–0.2
	"I do things without thinking"	0.1	-0.1–0.4	0.1	-0.2–0.4
	"I plan tasks carefully"	-0.3**	-0.6–0.1	-0.2	-0.5–0.1
	"I say things without thinking"	0.1	-0.2–0.4	0.1	-0.2–0.4
	"I tend to be absent-minded"	0.2	-0.1–0.5	0.2	-0.1–0.5
Risk aversion	"I sometimes follow another vehicle closely"	0.3**	0.1–0.6	0.2	-0.1–0.5
	"I drive a vehicle soon after drinking alcohol, but within the legal limit"	0.4**	0.1–0.7	0.2	-0.2–0.5
	"I drive a vehicle while distracted"	0.0	-0.3–0.3	0.1	-0.2–0.4
	"I drive a vehicle while feeling tired or fatigued"	0.6***	0.3–0.9	0.5***	0.1–0.8
	"I drive a vehicle while using a hands-free mobile phone"	0.4*	-0.0–0.7	0.3	-0.1–0.7
	"I often break speed limits"	0.1	-0.2–0.4	0.1	-0.2–0.4
	"I perform illegal driving manoeuvres"	-0.2	-0.4–0.1	-0.2	-0.5–0.1
	"Sometimes I overtake a vehicle by crossing double white lines"	0.4**	0.0–0.7	0.2	-0.2–0.6

****p<0.01, **p<0.05, *p<0.1*

Table 3: Attitudes to the law associated with unsafe driving practices

		Univariate analysis		Multivariate analysis	
		Beta	95% Confidence interval	Beta	95% Confidence interval
Lawlessness	"I avoid paying fares on public transport"	0.1	-0.2–0.4	-0.0	-0.3–0.3
	"I cheat on my taxes if I have a chance"	0.0	-0.3–0.3	0.1	-0.2–0.4
	"I claim government benefits to which I am not entitled"	0.7***	0.4–1.0	0.7***	0.4–0.9
	"I make illegal U-turns at intersections"	0.3**	0.0–0.6	0.4***	0.2–0.7
	"I signal when I make lane changes"	0.1	-0.2–0.4	0.1	-0.2–0.4
	"I sometimes accept bribes in the course of my duties"	0.5***	0.2–0.8	0.4**	0.1–0.7
	"I sometimes take pencils from work for private use"	0.4***	0.1–0.6	0.3**	0.1–0.6
	"I speed up in order to make it through yellow lights"	0.6***	0.3–0.9	0.6***	0.3–0.9
Normlessness	"If something works, it is less important whether it is right or wrong"	0.2	-0.6–0.9	0.1	-0.6–0.9
	"It is OK to get around laws and rules as long as nobody is aware of it"	0.2	-0.2–0.7	0.2	-0.3–0.6
	"Some things can be wrong to do even though they are legal"	0.3	-0.6–1.2	0.2	-1.1–1.5

****p<0.01, **p<0.05*

take pencils from work for private use" (β=0.3, $p<0.05$); and "I speed up in order to make it through yellow lights" (β=0.6, $p<0.01$). None of the statements about normlessness was associated with unsafe driving.

In the next step of the analysis, we used multivariate regression to explore associations between lawlessness and unsafe driving, controlling for sociodemographic and personality factors identified as significant in the preceding analysis (Table 4). In this model, unsafe driving was associated with: male gender (β=0.4, $p<0.01$); aggression ("Some people are just bad people", β=0.4, $p<0.05$); altruism ("I look down on others", β=0.5, $p<0.01$); and five statements asserting lawlessness ("I claim government benefits to which I am not entitled", β=0.5, $p<0.01$; "I make illegal U-turns at intersections", β=0.5, $p<0.01$; "I sometimes accept bribes in the course of my duties", β=0.3, $p<0.05$; "I sometimes take pencils at work for private use", β=0.3, $p<0.05$; and "I speed up in order to make it through yellow lights", β=0.5, $p<0.01$). No associations were observed between unsafe driving and impulsivity or risk aversion in this multivariate model.

In the final step of the analysis, we estimated a multivariate regression model of factors associated with unsafe driving, including only the variables that were significant in the preceding model (Table 5). In this model, unsafe driving was associated with male gender (β=0.5, $p<0.01$), aggression ("Some people are just bad people", β=0.4, $p<0.05$), altruism ("I look down on others", β=0.5, $p<0.01$), and all five statements affirming lawlessness ("I claim government benefits to which I am not entitled", β=0.6, $p<0.01$; "I make illegal U-turns at intersections", β=0.5, $p<0.01$; "I sometimes accept bribes in the course of my duties", β=0.3, $p<0.05$; "I sometimes take pencils at work for private use", β=0.4, $p<0.01$; "I speed up in order to make it through yellow lights", β=0.6, $p<0.01$). The model was significant ($p<0.05$) and accounted for 18.4% of the variance in unsafe driving (adjusted $R^2 = 0.184$).

Discussion

This study is, to our knowledge, the first paper of its kind to use the Response Time Method to analyse driver behaviours that endanger pedestrians. Our findings are congruent with prior empirical research on the topic, strengthening arguments in favour of applying this technique in future road safety research, particularly in studies in which honest responses from participants cannot be reliably solicited using conventional survey methods. Our findings support previous research that unsafe driving behaviours are a function of sociodemographic and personality factors. Crucially, our data show that lawlessness (defined as a general disregard for the law) is also an important determinant of unsafe driving, even when controlling for sociodemographic and personality factors. As this research only focused on the attitudes of drivers, it cannot say anything, for instance, about the role of infrastructure in crashes.

Our data show that male drivers in South Africa are more likely than female drivers to engage in unsafe driving that endangers pedestrians, as previously reported in other studies on driving behaviour.[14,15,45] We found that male gender was associated with unsafe driving, even when controlling for the effects of personality and attitudes to the law, which appears to be a novel finding. Although level of education was associated with unsafe driving in multivariate regression analysis, after controlling for the effects of other sociodemographic variables, this association was not significant when considering personality factors and attitudes to the law. Furthermore, our data indicate that driving behaviours that endanger pedestrians are associated with four dimensions of motorists' personality, namely aggression, impulsivity, risk tolerance, and altruism, even when controlling for sociodemographic factors. These findings support the assertion that personality is a determinant of driving style in South Africa, as has been found in high-income Western countries.[15,19,20,22,25]

The main result from our analysis, however, points to lawlessness as a significant contributor to driving behaviours that endanger pedestrians, even when controlling for sociodemographic and personality factors. Indeed, our findings suggest that a culture of lawlessness may represent a significant risk for the safety of pedestrians in South Africa. Furthermore, our data indicate that lawlessness may be more important than normlessness, even though it is well established that social norms exert a strong influence on driver behaviours.[46] If one considers the relationship between norms and laws, three possibilities may arise: social norms and formal laws support one another; the two are in conflict; or there is some level of absence of formal laws that results in social norms governing behaviour. Du Plessis et al.[47] have shown that South Africa has a good set of traffic laws compared to other countries, but the incidences of traffic-related deaths are still relatively high. The authors argue that this divergence may be explained by social norms that counter formal laws. Similarly, Acemoglu and Jackson[29] suggest

Table 4: Multivariate logistic regression analysis of associations between lawlessness and unsafe driving, controlling for sociodemographic and personality factors

		Beta	95% Confidence interval
Sociodemographic factors	Education	-0.3	-0.7–0.2
	Male gender	0.4***	0.2–0.7
Aggression	"I sound my horn to indicate my annoyance to another road user"	0.1	-0.2–0.4
	"Some people are just bad people"	0.4**	0.0–0.7
	"Sometimes passengers tell me to calm down because I am angry at other drivers"	0.2	-0.1–0.5
Altruism	"I look down on others"	0.5***	0.2–0.7
Impulsivity	"I am a careful thinker"	-0.2	-0.5–0.1
	"I concentrate easily"	-0.3	-0.6–0.0
Risk aversion	"I drive a vehicle while feeling tired or fatigued"	0.3	-0.0–0.6
Lawlessness	"I claim government benefits to which I am not entitled"	0.5***	0.2–0.7
	"I make illegal U-turns at intersections"	0.5***	0.2–0.7
	"I sometimes accept bribes in the course of my duties"	0.3**	0.0–0.6
	"I sometimes take pencils from work for private use"	0.3**	0.0–0.6
	"I speed up in order to make it through yellow lights"	0.5***	0.2–0.8

aR^2=0.211, p<0.05

****p<0.01, **p<0.05*

Table 5: Multivariate logistic regression analysis of associations between lawlessness and unsafe driving, controlling for sociodemographic and personality factors

		Beta	95% Confidence interval
Sociodemographic factors	Male gender	0.5***	0.2–0.8
Aggression	"Some people are just bad people"	0.4**	0.0–0.8
Altruism	"I look down on others"	0.5***	0.3–0.8
Lawlessness	"I claim government benefits to which I am not entitled"	0.6***	0.3–0.8
	"I make illegal U-turns at intersections"	0.5***	0.2–0.7
	"I sometimes accept bribes in the course of my duties"	0.3**	0.0–0.6
	"I sometimes take pencils from work for private use"	0.4***	0.1–0.6
	"I speed up in order to make it through yellow lights"	0.6***	0.3–0.9

****p<0.01, **p<0.05*

lawlessness may increase when dominant societal norms are in conflict with laws, resulting in a converse effect.

Hashemiparast et al.[28] found participants' pessimism and distrust of authorities contributed to their proclivity to defy the rules and regulations of the road, disobey the law and engage in unsafe, unlawful driving practices. For example, Sinclair attributes normlessness in South Africa to widespread corruption in government.[31] More recently, Murphy et al.[48] and de Bruijn[49] found that compliance with COVID regulations was not significantly affected by the risk of legal sanction. This suggests that compliance cannot simply be enforced by authorities. Instead, normative concerns were shown to be central to promoting individuals' sense of duty to support and obey laws.[48,49] Murphy et al.[48] recommend persuading people of their sense of duty and responsibility so that they engage in actions that protect others (especially the most vulnerable) and remind them of their duty. De Bruijn et al.[49] suggest three factors play a significant role in COVID regulation compliance: morality, perception and the situation. First, they found a positive correlation between compliance and moral support of the law. Further, when the obligation to comply was higher, so was lawfulness (moral support compliance). Second, when laws and their enforcement are perceived as just and reasonable, the probability of compliance increases. Finally, compliance increased when the environment favoured it and decreased when the environment favoured violation. Our findings in this study support the argument that the link between social norms and laws must be considered if traffic laws are to be successfully implemented, despite the possible influence of other factors (such as inadequate law enforcement and accountability of law enforcement to uphold the law).

The study has several limitations, including the small sample size, the use of a self-selected (non-probability) sample from one geographical region, and the use of survey items to assess aspects of personality that have not been validated for use in this population. The sample also consisted of university students and staff, which limits the generalisability of findings. Nonetheless, the study is a first step towards conducting similar studies in samples that are more representative of South African motorists and pedestrians. Replicating the study with more representative

probability samples could have important implications for public health measures to improve pedestrian safety in South Africa, the most pertinent of which is that simply imposing stricter rules and/or higher penalties for unsafe driving is unlikely to have any positive impact unless attitudes of lawlessness are addressed. Importantly, this study shows how novel research methods could be used to improve our understanding of factors that influence motorists' and pedestrians' safety behaviours.

Conclusion

Our study is the first of its kind in South Africa to investigate associations between driving behaviours that endanger pedestrians, personality factors, and attitudes to the law. Our data indicate that while some sociodemographic and personality factors may influence driving style, lawlessness is an important determinant. The significance of this finding is that lawlessness, unlike personality and sociodemographic factors, is a potentially modifiable risk factor for unsafe driving. To the extent that our findings are generalisable, they suggest that current traffic laws are not going to achieve improved outcomes without further attempts to improve enforcement or change motorists' attitudes to the law. Future research in South Africa could employ behavioural experiments and controlled trials to give policy directives on how to change motorists' attitudes to the law to promote pedestrian safety. Our study should also be replicated in larger, more representative probability samples.

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Competing interests

We have no competing interests to declare.

Authors' contributions

J.B.: Conceptualisation; methodology; formal analysis; writing – review and editing; funding acquisition. S.d.P.: Conceptualisation; methodology; software; writing – review and editing; project administration; funding acquisition. A.J.: Conceptualisation; methodology; formal analysis; writing – review and editing. P.S.: Writing – original draft preparation; writing – review and editing; project administration.

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Appendix: Survey statements (agree/disagree)

Unsafe driving practices:
I stop at marked pedestrian crossings when people want to cross
I stop for pedestrians who want to cross a street where there are no traffic crossings
I have been involved in an accident involving a pedestrian
I slow down when I see a marked pedestrian crossing
I think jaywalking is a problem
I eat or drink while I drive
When approaching a pedestrian cross, I look for someone who would like to cross
I fail to notice when a traffic light turns green
I avoid driving at night
I talk on my hand-held cell phone when driving
I forget where I have parked my car
Aggression:
The wealthy capitalise on those who are less fortunate
Some people are just bad people
The rich get richer by taking advantage of the poor

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Appendix continued...

Getting back at others makes me feel better
Large corporations exploit their employees
I have the right to retaliate if I am betrayed
I feel the need to get even if someone disrespects me
Some people are simply horrible human beings
A passenger told me to calm down because I am angry at other drivers
I sound my horn to indicate my annoyance to another road user
Altruism:
I make people feel welcome
I anticipate the needs of others
I love to help others
I am concerned about others
I have a good word for everyone
I look down on others
I am indifferent to the feelings of others
I make people feel uncomfortable
I turn my back on others
I make time for others
Impulsivity:
I plan tasks carefully
I do things without thinking
I don't 'pay attention'
I am self-controlled
I concentrate easily
I am a careful thinker
I say things without thinking
I act on the spur of the moment
Risk aversion and risk perception:
I drive a vehicle while feeling tired or fatigued
I drive a vehicle while using a hands-free mobile phone
I drive a vehicle while distracted (e.g. due to drinking, eating, smoking, changing a CD)
I drive at 70 km/h in a designated 60 km/h speed zone
I perform illegal driving manoeuvres (e.g. doughnuts, drifting)
I don't mind driving while closely following another vehicle (at a less than 2 s following distance)
Sometimes I overtake a vehicle by crossing double white lines
I drive a vehicle soon after drinking alcohol but within the legal BAC limit of 0.05
I drive at 120 km/h in a designated 100 km/h speed zone
Lawlessness:
I claim government benefits to which I am not entitled
I avoid paying fares on public transport

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Appendix continued...

I take pencils from work for private use
I cheat on my taxes if I have a chance
I accept bribes in the course of my duties
I signal when I make lane changes
I make illegal U-turns at intersections
I speed up in order to make it through yellow lights
Normlessness:
It is all right to do anything you want as long as you stay out of trouble
It is OK to get around laws and rules as long as you don't break them directly
If something works, it is less important whether it is right or wrong
Some things can be wrong to do even though it is legal to do them