How do fatalistic beliefs affect the attitudes and pedestrian behaviours of road users in different countries? A cross-cultural study

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Abstract

This paper reports on an exploratory investigation of the influence of five different types of fatalistic belief constructs (namely divine control, luck, helplessness, internality, and general fatalism) on three classes of self-reported pedestrian behaviours (memory and attention errors, rule violations, and aggressive behaviours) and on respondents' general attitudes to road safety, and how relationships between constructs differ across countries. A survey of over 3,400 respondents across Bangladesh, China, Kenya, Thailand, the UK, and Vietnam revealed a similar pattern for most of the relationships assessed, in most countries; those who reported higher fatalistic beliefs or more external attributions of causality also reported performing riskier pedestrian behaviours and holding more dangerous attitudes to road safety. The strengths of relationships between constructs did, however, differ by country, behaviour type, and aspect of fatalism. One particularly notable country difference was that in Bangladesh and, to a lesser extent, in Kenya, a stronger belief in divine influence over one's life was associated with safer attitudes and behaviours, whereas where significant relationships existed in the other countries the opposite was true. In some cases, the effect of fatalistic beliefs on self-reported behaviours was mediated through attitudes, in other cases the effect was direct. Results are discussed in terms of the need to consider the effect of locus of control and attributions of causality on attitudes and behaviours, and the need to understand the differences between countries therein.

Keywords
Pedestrian behaviour, traffic safety, fatalism, attitudes, low- and middle-income countries

1. Introduction

The acceptance of road traffic accidents as a public health problem is something that, despite its relatively long history (e.g. Norman, 1962; Asogwa, 1978), has only in recent years truly been gaining traction (e.g. Nantulya & Reich, 2002; Ameratunga et al. 2006; Sharma, 2008; GRSF & IHME, 2014; Polinder et al. 2015). Although those in high-income countries own over half of the world's vehicles, it is in low- and middle-income countries that 90% of the fatalities occur (WHO, 2018; GRSF & IHME, 2014). Despite the many differences, one thing that unites all countries' road transport systems is the influence of human behaviour, something that affects safety outcomes across all cultures and nations. If we can affect human behaviour, we can influence the safety performance of any road transport system.

Among the many determinants of behaviour, underlying beliefs and values have been identified as relevant in road traffic contexts (Kouabenan, 1998). A class of belief that is of particular interest is that which concerns control over one's situation. In Ajzen's (1985) Theory of Planned Behaviour the term *perceived behavioural control* is used; in Bandura's (1977) social cognitive theory it is referred to as *self-efficacy*; in Rosenstock's (1974) health belief model it is the *perceived capacity* to undertake actions. In the decades since these theories' rise to prominence, myriad studies have been undertaken that point to control beliefs as significant determinants of health behaviour (see, for example, Conner & Norman, 2005). In the road safety context, research consistently demonstrates that a belief in, or a feeling of control is necessary for the performance of safe or protective on-road behaviours (e.g. Parker et al. 1992; Wells-Parker et al. 2000; Elliot et al. 2003; Lajunen & Räsänen, 2004; Freeman et al. 2005; Cestac et al. 2011). The opposite of this, i.e., the feeling of a lack of control, can be equally powerful; one conceptualisation of this is fatalism.

Fatalism has been defined and operationalised in a variety of different ways over the past 50 years. Parker and Kleiner (1966) talked of fatalism as a response to uncontrollable life situations; Kuhr (1975) described it as the idea that all occurrences are pre-ordained; Wheaton (1983) talked of the belief that events happen due to external rather than internal causes; Comas-Diaz (1989) discussed the perception of events as the result of powers beyond control, such as luck or divine influence; and Futa et al. (2001) described it as "the acceptance of one's situation" (p.196) and the subsequent lack of motivation to attempt to exert control over that situation. More recently, Nguesta and Kouabenan (2017) described fatalistic beliefs as those that are "rooted in a kind of inevitability or assumed determinism of events, especially unfortunate ones" (p.308).

1   When considering traffic safety specifically, the possession of fatalistic beliefs has

2   been shown to have direct relevance (Kouabenan, 1998; Dixey, 1999). In Kouabenan's

3   (1998) study, religious, mystical, and fatalistic beliefs were discussed in terms of their effect

4   on people's explanations of accidents. Kouabenan described fatalism as a kind of

5   attributional error, one that arises from an individual's need to reduce the dissonance that

6   arises from living in an unpredictable and seemingly uncontrollable world. From his survey

7   of 533 West African taxi drivers, Kouabenan found that fatalistic individuals were more

8   likely to attribute accidents to external factors (e.g. bad state of roads, absence of pavements,

9   etc.) than to factors under the driver's control (e.g. carelessness or fatigue, poor estimation of

10   danger, etc.), with such beliefs leading to a neglect of safety measures (Kouabenan, 1998).

11   Dixey (1999) found similar results in an interview study with the Yaruba people of

12   Nigeria, whose culture is one that holds pre-destination as central to its worldview. One

13   interviewee explained that when riding a motorcycle "he did not wear a motorcycle helmet as

14   he had consulted the *babalawo* [traditional priest] and knew that he was in no danger"

15   (Dixey, 1999, p.202). This perceived lack of a need to perform protective behaviours was

16   also observed by Peltzer (2003) in South Africa; those of a more fatalistic orientation were

17   less likely to be seen wearing a seat-belt than their less fatalistic counterparts. More recently,

18   Omari and Baron-Epel (2013) found relationships between fatalistic beliefs and the use of in-

19   vehicle child restraints, and Maghsoudi et al. (2017) showed the same relationship between

20   fatalism and motorcycle helmet use; in both cases, a higher degree of fatalistic beliefs was

21   linked with a lower rate of safety equipment usage.

22   In terms of more general on-road behaviour, Peltzer and Renner (2003) showed that

23   the fatalistic beliefs of South African taxi drivers, in the form of superstition, significantly

24   contributed to the probability of engaging in risky behaviours and being involved in an

25   accident (Peltzer & Renner, 2003). Nordfjærn et al. (2012) and Şimşekoğlu et al. (2013)

26   report similar findings; fatalistic beliefs strongly predict the performance of risky driving

27   behaviours in both Turkish and Iranian settings. Most recently still, Ngueutsa and Kouabenan

28   (2017) showed the same kind of relationship in a Cameroonian context, and Şimşekoğlu and

29   Nordfjærn (2017) in Turkish professional drivers; fatalism is consistently linked with more

30   unsafe driving behaviours.

31   Each of these studies had its own conceptualisation of fatalism, some linking it with

32   superstition (e.g. Peltzer & Renner, 2003), others connecting it with destiny and fate (e.g.

33   Dixey, 1999). In a series of studies, Kayani et al. (2011; 2012; 2017) considered traffic safety

34   in terms of Elder's (1966) two categories of fatalism; empirical fatalism, a belief that events

1 cannot be controlled nor their causes understood, and theological fatalism, a belief that

2 outcomes (and destiny) are controlled by a higher power (such as God, spirits, or karma;

3 linked closely with religiosity). In their 2012 interview study, Kayani et al. found that

4 fatalistic beliefs were strongly linked to religion in Pakistan, with most participants

5 considering injury and death on the roads as "fated to happen and therefore unpreventable"

6 (p.1048). In their 2017 paper, they explored superstitious beliefs and practices, finding that

7 such beliefs were influential in both the attribution of causality (e.g., through another using

8 black magic or giving the 'evil eye'), and in protection from harm (e.g., through use of

9 religious objects and practices to protect oneself; Kayani et al. 2017).

10 Caution should be exercised, however, when considering fatalism and religiosity

11 together, as the two do not necessarily influence behaviour through the same mechanism.

12 Yıldırım (2007), in a survey study of a predominately Muslim, Turkish sample, found that

13 religiousness had a *positive* effect on traffic behaviour (i.e., that behaviour was safer), for

14 both drivers and pedestrians. The author explained this in terms of the orientation towards

15 rule following and risk avoidance in the Turkish context (Yıldırım, 2007). Similar results

16 were found in a study of adolescent road user behaviour in Iran; higher engagement in

17 religious activities was found to be linked with safer behaviours (Nabipour et al. (2015).

18 It is likely that findings will depend to some extent on how fatalism is conceptualised

19 and measured. In the research cited above, there are almost as many different tools for

20 measuring fatalism as there are studies published on the matter. This is also true in the

21 literature beyond the traffic studies cited above. In a review, Esparza (2005) found that at

22 least 51 different scales had been used in various contexts, varying significantly in content.

23 They included, to lesser or greater extents, concepts such as mastery, coping, locus of control,

24 helplessness, divine influence, world views, safety beliefs and attitudes, fear of death, and

25 aspects of personality (Esparza, 2005). To bring together all of these efforts into one tool,

26 Esparza et al. (2015) condensed this variety of different conceptualisations and related

27 concepts into one validated, multidimensional measure of fatalism (and its related

28 constructs). The resulting questionnaire measured five related but distinct underlying factors;

29 general fatalism (e.g., 'If bad things happen, it is because they were meant to happen'),

30 helplessness (e.g., 'I feel that nothing I can do will change things'), internality (e.g., 'My life

31 is determined by my own actions'), luck (e.g., 'When I get what I want, it's usually because I

32 am lucky'), and divine control (e.g., 'God controls everything good and bad that happens to a

33 person').

1   Esparza et al. (2015) developed their questionnaire simultaneously in both English and

2   Spanish, arguing that a linguistically de-centred tool would be particularly useful for cross-

3   cultural research. It is not known, however, how these different concepts of fatalism might

4   vary across cultures in terms of their effect on road safety. Cross-cultural studies of fatalism

5   and road safety do indeed exist; those reported by Nordfjærn et al. (2012) and Şimşekoğlu et

6   al. (2013), cited above, included aspects of culture in their investigations. Specifically,

7   Şimşekoğlu et al. (2013) showed that Turkish road users held less fatalistic beliefs and

8   reported safer driving behaviours than their Iranian counterparts, while Nordfjærn et al.

9   (2012) found that fatalism strongly predicted risky driving behaviour in Turkey, but not in

10   Norway. These researchers did not, however, use pre-validated measures of fatalism, rather,

11   they used a short set of questions (six and fifteen items in Nordfjærn et al. (2012) and

12   Şimşekoğlu et al. (2013) respectively) that were created solely for use in their own research.

13   The aforementioned adolescent pedestrian behaviour study reported by Nabipour et al. (2015)

14   did use a pre-validated measure; however, this was a specific measure of religiosity (the

15   Duke University Religion Index; DUREL), not a general measure of fatalism. To our

16   knowledge, there currently exist no traffic safety studies that use pre-existing, pre-validated

17   tools for measuring the concept of fatalism (and its related constructs).

18   This question is of particular importance for the current research given the results of

19   Kayani et al. (2017), Yıldırım (2007), and Nabipour et al. (2015). Although all were set in

20   predominately Muslim countries (Pakistan, Turkey, and Iran, respectively), Kayani et al.

21   (2017) found that religion and religious objects were perceived as providing protection from

22   accidents (linked with reduced engagement in protective behaviour), whereas Yıldırım (2007)

23   and Nabipour et al. (2015) found that religiousness had a positive effect on traffic safety.

24   Although Yıldırım and Nabipour explained their results in terms of the rule following

25   orientation and pro-social behaviours promoted in religious institutions in Islamic countries,

26   it is possible that these differences arose from the different approaches used by the

27   researchers. Kayani et al. interviewed their participants, whereas Yıldırım used pre-existing

28   questionnaires. It is therefore difficult to assess the extent to which they were both measuring

29   fatalism, aspects of it, or concepts related to it.

30   The question also rises with regards to investigations by Kayani et al. (2017), Peltzer

31   and Renner (2003), Kouabenan (1998), and Dixey (1999), in which 'superstition' was the

32   focus. As already noted, researchers in the traffic safety field have used many different ways

33   of measuring what all suggest is 'fatalism'; the literature is lacking an exploration of the

34   underlying constructs (for example, a belief in luck, or divine control), and how these differ

across cultures. It is possible that underlying constructs relate differently to traffic behaviours in different countries, with some constructs more influential than others, and differences in effects depending on the country under investigation. Nordfjærn et al.'s (2012) finding that fatalism predicts unsafe behaviours in Turkey but not Norway suggests this to be the case; however, it is unclear what factors of fatalism or control beliefs lie at the root of these differences.

Finally, the majority of the research referenced above focuses on fatalism and *driver* behaviour (the Nabipour et al. (2015) study providing a notable exception). Aberrant driver behaviour is undeniably a major risk factor on the roads; however, it is the pedestrian that carries the weight of the road traffic injury burden around the world, and it has been argued that many of the accidents occur when pedestrians do not obey traffic rules (Zhuang & Wu, 2011). Regardless of the causes of accidents, pedestrians make up 50% of road traffic fatalities in some regions (particularly Sub-Saharan Africa; GRSF & IHME, 2014), and are far more likely to be killed for each kilometre travelled than are car drivers (e.g., DfT, 2017).

It is also the case that only a specific sub-section of society can interact with the road system as a car driver (i.e., those that have a license and access to a car), whereas (almost) all members of society are able to, and habitually do, interact with the road system as a pedestrian. As such, any car driver focussed research will always exclude a significant number of potential road users. Given comparatively low car ownership rates in low- and middle-income countries, bias towards specific sub-sections of society is even more pronounced in these settings. As such, pedestrian focussed road safety research is needed across nations, with the need especially evident in low-and middle-income countries, where the road safety burden is felt most keenly.

2. Aims and setting

The principle aim of the current study is to assess the extent to which fatalistic beliefs are associated with attitudes to traffic safety and self-reported pedestrian behaviours. Existing research has shown that risky or dangerous behaviour as a driver is significantly correlated with dangerous behaviour as a pedestrian (Taubman-Ben-Ari & Shay, 2012; Şimşekoğlu, 2015). Given the relationship between fatalism and driver behaviour, one could reasonably envisage a relationship between fatalism and pedestrian behaviour to exist; however, to our knowledge this has not yet been confirmed.

1   A second aim of this research is to investigate the nature of the relationships between

2   fatalistic beliefs, attitudes to traffic safety, and self-reported pedestrian behaviours, and how

3   these might differ across nations. A large body of research exists pointing to the relationship

4   between road safety attitudes and road user behaviour, for drivers (e.g., Iversen & Rundmo,

5   2004) and for pedestrians (e.g., Şimşekoğlu 2015). Of interest in the current research is the

6   extent to which fatalistic beliefs affect these attitudes, and whether this relationship varies

7   across countries. Additionally, given previous road traffic studies suggesting that the

8   relationship between such distal factors and behaviour are mediated through attitudes (e.g.

9   Ulleberg & Rundmo, 2003; Nordfjærn & Şimşekoğlu, 2013), of interest here is whether this

10   relationship is indeed mediated through attitudes, and to what extent this mediation differs

11   across countries.

12   To achieve these aims, we use a more complete version of the data set we used

13   in a validation of the pedestrian behaviour questionnaire across six countries, namely

14   Bangladesh, China, Kenya, Thailand, the UK, and Vietnam (see McIlroy et al. 2019).

15   Bangladesh represents a low-income country, Kenya and Vietnam lower-middle-income

16   countries, Thailand and China upper-middle-income countries, and the UK a high-income

17   country (World Bank, 2018). The countries have varying motorisation and road traffic

18   fatality rates, as can be seen in Table 1.

19

20   Table 1. Summary of WHO (2018) estimated fatality rates by population and by motorisation for countries
21   involved in the research.

	Bangladesh	China	Kenya	Thailand	UK	Vietnam
People per registered vehicle	57	4.8	16.3	1.8	1.8	1.9
Fatality rate per 10,000 vehicles	86.7	8.7	45.2	6.0	0.53	4.9
Fatality rate per 100,000 population	15.3	18.2	27.8	32.7	3.1	26.4

22   Notes: All data come from WHO (2018) and are for the year 2016. 'Vehicles' include motorised two- and three-wheelers,
23   cars and four-wheeled light vehicles, trucks, buses, and other motorised vehicles (WHO, 2018).

24

25   In terms of the relationship between fatalistic beliefs and pedestrian behaviour,

26   following the majority of the research summarised above we hypothesise that higher fatalistic

27   beliefs will be associated with higher reporting of risky pedestrian behaviours. Regarding the

28   specific aspects of fatalistic beliefs in the questionnaire (e.g. general fatalism, divine control,

29   luck, etc.), and how their relationships with behaviour might vary across cultures, or how

30   these relate to pedestrian behaviours, we leave these questions open, without specific

hypotheses, with one exception; based on the above cited research in Islamic cultural settings, we hypothesise a greater belief in divine control (related to religiosity) to be related to safer pedestrian behaviours in Bangladesh.

In terms of the relationships with attitudes to road safety, we leave the question largely open. Given the link between attitudes and behaviour, one could reasonably expect beliefs to have a similar effect on both. Alternatively, it could be that the effect of beliefs on behaviours found in existing research was a result of the beliefs influencing attitudes, rather than influencing behaviour directly, i.e., that the relationship between beliefs and behaviours is mediated by attitudes. These questions are approached in an exploratory manner.

3. Method

3.1 Survey Instrument

The sections analysed for the current research come from a larger survey (from which separate articles have been produced; McIlroy et al. 2019; McIlroy et al. 2020; Dinh et al. 2020). For the purposes of the analyses presented here, four sections are of relevance; demographics, fatalistic beliefs, attitudes to road safety, and pedestrian behaviour.

The demographics section included questions regarding gender, age, religion, and transport choices. To measure fatalistic beliefs, we used the short version Esparza et al.'s (2015) questionnaire. The measure consists of 30 questions measuring five factors (i.e., six questions for each factor); fatalism, helplessness, internality, luck, and divine control. All items are measured on a five-point Likert scale, from 'strongly agree' to 'strongly disagree'. More detail on this section is provided in Section 4.2, below.

To measure road safety attitudes, 13 questions grouped under a single factor were used. The items asked respondents to rate how much they agreed with a given statement (e.g., 'Many traffic rules must be ignored to ensure flow') on a five-point Likert scale, from 'strongly agree' to 'strongly disagree'. The majority of items were taken from Iversen and Rundmo (2004) and Peltzer and Renner (2003). We refer the interested reader to McIlroy et al. (2020) for more detail on the development and factor analysis of the attitudes section.

For the measurement of pedestrian behaviour, we used the short version of the aforementioned Pedestrian Behaviour Questionnaire (PBQ; Granié et al. 2013; Deb et al. 2017), in which respondents are asked about the extent to which they perform various risky on-road behaviours. Although original versions of the PBQ had four or five factors, in our own previous work using the same data set (McIlroy et al. 2019), we found a model with only three factors included to provide the best fit to the data; violations (intentional rule breaking;

e.g., 'I take passageways forbidden to pedestrians to save time'), aggressions (aggressive pedestrian behaviours; e.g., 'I cross very slowly to annoy a driver'), and lapses (memory or attention errors; e.g., 'I run across the street without looking because I am in a hurry'). Each factor comprised four items, and responses were measured on a six-point Likert scale, from 'extremely infrequently or never' to 'extremely frequently or always'.

All questionnaires were translated (from their original English versions) by researchers for whom the target language was their own native language, resulting Bengali, Chinese, Swahili, Thai, and Vietnamese versions of the questionnaire. The translations were back-translated (into English) in accordance with guidelines described by Brislin (1970), and the original and back-translated versions compared. Any inconsistencies were discussed between researchers in the UK and those in the non-English speaking nations until consensus was reached.

3.2 Ethics, Sampling, and Respondents

Ethical approval for data collection was sought from, and granted by the University of Southampton ethics board (Ethics ID 40682). This covered data collection activities across all countries. According to local requirements, additional ethical approval for activities in Kenya was sought from, and granted by the Strathmore University Institutional Ethics Committee (ID SU-IRB 0214/18). Fully informed consent was gained from all respondents, all responses were anonymous, and no identifying data was collected.

For the Bangladesh sample, responses were taken from in Dhaka city and 13 districts outside the capital. All responses were recorded on paper; some respondents filled out the questionnaire themselves, while others were conducted in an 'interview' style (to capture those unable or unwilling to read or write), whereby a researcher marked answers on the form for the respondent. All sampling took place in busy public areas (e.g., markets, malls, transport hubs, etc.), thereby representing a convenience sampling method. In China, all responses were gathered online through the Wenjuanxing online survey platform (www.wjx.cn). This platform advertised the link; in addition, a link to the website was posted in various social media platforms. As such, convenience and snowball sampling methods were used. In Kenya, responses were gathered both on paper and online, using Google Forms. Paper questionnaires were handed out to students and staff at Strathmnore University, Nairobi. Willing respondents were asked to return completed forms at a later date, or given the link to the online version. The link was also advertised on various social media platforms,

1   with the request that it be further passed on. Again, convenience and snowball sampling

2   methods were used.

3   In Thailand, all responses were gathered using the University of Southampton's

4   iSurvey platform. Again, social media was used to advertise the link, with respondents being

5   asked to pass on the link to friends and family, and advertise it publicly where possible. As

6   such, a snowball sampling method was used. UK responses were also gathered via the

7   University of Southampton's online iSurvey platform, and via paper-based questionnaires.

8   Regarding online data collection, a link to the online questionnaire was sent out to friends

9   and family of UK-based researchers using various social media platforms, which was

10   subsequently passed on to further acquaintances, thus representing a snowball sampling

11   approach. To gather paper-based responses, convenience sampling was used. Researchers

12   went to local commercial centres and handed out paper surveys. Accepting individuals were

13   left alone while they completed the questionnaire. Paper questionnaires were also distributed

14   around shops and cafes, and collected on subsequent days.

15   Finally, in Vietnam, all responses were recorded on paper. Researchers handed out

16   questionnaires in public places in Hanoi and other provinces, as well as giving questionnaires

17   to friends, family members, and acquaintances, thereby representing both convenience and

18   snowball sampling methods. As in Bangladesh, where requested, questions were read out to

19   respondents and responses recorded on paper by the researcher (again, aiming to capture

20   those unable or unwilling to read the questions and/or make their responses). Completed

21   forms were either collected immediately, or an appointment was made for collection at a later

22   date.

23   In total, 3,423 responses were gathered across the six countries (following removal of

24   44 from the Kenya sample due to excessive missing items); 532 from Bangladesh, 544 from

25   China, 500 from Kenya, 317 from Thailand, 695 from the UK, and 835 from Vietnam. Age

26   and gender splits are presented in Table 2; 22 respondents did not give answers to one or both

27   of these questions, and ten answered 'prefer not to say' or 'other' to the question regarding

28   gender (hence the total of 3391 in Table 2; displayed percentages are with respect to this

29   total).

30   As expected, respondents from the six countries differed in their responses to the

31   question concerning religion; this was answered by 3,415 respondents, results for which are

32   presented in Table 3. Bangladesh respondents were almost exclusively Muslim, Kenya

33   respondents almost exclusively Christian, and Thailand respondents almost exclusively

34   Buddhist. In China, the UK, and Vietnam, the majority reported having no religion, with the

1 next largest groups being Buddhist in China and Vietnam, and Christian in the UK (see Table

2 3).

3

4 Table 2. Age and gender splits. Percentages are with respect to the total number of people in each country
5 sample that answered the age question and identified as male or female (rounded to the nearest full percentage
6 point).

		18-24	25-34	35-44	45-54	Over 54	Totals
Bangladesh	Male	161 (30%)	111 (21%)	61 (11%)	49 (9%)	37 (7%)	419 (79%)
	Female	55 (10%)	29 (5%)	10 (2%)	12 (2%)	7 (1%)	113 (21%)
China	Male	23 (4%)	113 (21%)	78 (14%)	12 (2%)	3 (<1%)	229 (42%)
	Female	60 (11%)	189 (35%)	51 (9%)	13 (2%)	1 (<1%)	314 (58%)
Kenya	Male	159 (32%)	48 (10%)	16 (3%)	5 (1%)	5 (1%)	233 (47%)
	Female	172 (34%)	49 (10%)	31 (6%)	13 (3%)	2 (<1%)	267 (53%)
Thailand	Male	6 (2%)	46 (15%)	31 (10%)	11 (4%)	25 (8%)	119 (38%)
	Female	3 (1%)	85 (27%)	62 (20%)	19 (6%)	26 (8%)	195 (62%)
UK	Male	64 (10%)	55 (8%)	45 (7%)	54 (8%)	85 (13%)	303 (45%)
	Female	103 (15%)	116 (17%)	47 (7%)	45 (7%)	53 (8%)	364 (55%)
Vietnam	Male	178 (21%)	105 (13%)	81 (10%)	74 (9%)	54 (6%)	492 (59%)
	Female	80 (10%)	89 (11%)	77(9%)	64 (8%)	33 (4%)	343 (41%)
Total	*Male*	*591 (17%)*	*478 (14%)*	*312 (9%)*	*205 (6%)*	*209 (6%)*	*1795 (53%)*
	Female	*473 (14%)*	*557 (16%)*	*278 (8%)*	*166 (5%)*	*122 (4%)*	*1596 (47%)*
	All	*1064 (31%)*	*1035 (31%)*	*590 (17%)*	*371 (11%)*	*331 (10%)*	*3391 (100%)*

7

8 Table 3. Self-reported religious affiliation. Percentages are with respect to the total number of people in each
9 country sample that answered the question (rounded to the nearest full percentage point).

	No religion	Buddhist	Christian	Hindu	Jewish	Muslim	Sikh	Any other	Total
Bangladesh	0	0	1 (<1%)	51 (10%)	0	480 (90%)	0	0	532 (16%)
China	437 (87%)	82 (15%)	19 (3%)	0	1 (<1%)	4 (1%)	0	1 (<1%)	544 (16%)
Kenya	11 (2%)	1 (<1%)	469 (94%)	1 (<1%)	2 (<1%)	13 (3%)	2 (<1%)	1 (<1%)	500 (15%)
Thailand	12 (4%)	295 (93%)	5 (2%)	0	0	5 (2%)	0	0	317 (9%)
UK	396 (58%)	22 (3%)	210 (31%)	13 (13%)	12 (2%)	21 (3%)	8 (1%)	5 (1%)	687 (20%)
Vietnam	551 (66%)	244 (29%)	37 (4%)	1 (<1%)	2 (<1%)	0	0	0	835 (24%)
Total	*1407 (41%)*	*644 (19%)*	*741 (22%)*	*66 (2%)*	*17 (<1%)*	*523 (15%)*	*10 (<1%)*	*7 (<1%)*	*3415 (100%)*

10

11

12 Differences in sampling methods used across the countries reflected different levels of

13 available resources, expertise, access to respondents, experience in data collection, and

14 overall road systems; as such, the samples obtained differed in several ways. As can be seen

15 from Table 2, age and gender splits were not equal across samples. Given the effects of age

16 and gender found in our own previous work with the same data set, these variables were

17 included in subsequent analyses as covariates in order to allow for the identification of the

18 effects of fatalistic beliefs on road safety attitudes and self-reported pedestrian behaviours

19 after taking age and gender differences into account (as was done in Nordfjærn et al. 2012).

20 The samples also differed significantly in terms of the primary modes of transport

21 used in each country, as can be seen from Table 4. In Bangladesh, additional response

options were included; of the 223 respondents under 'Other' in Table 4, 121 (23%) indicated being a passenger in a bicycle rickshaw as their most commonly use mode of transport, while 75 (14%) indicated that it was as a passenger in a motorised three-wheeler. The remaining 'Other' responses included rickshaw drivers, bus drivers, and 'Other mode of transport as passenger or driver'. Although primary mode choice is related to road safety attitudes and self-reported pedestrian behaviours (see section 4.3, below), this variable was not included in all of the subsequent analyses. These modal shares reflect differences in the road systems used by the respondents in the different countries (though we attracted more car users in Thailand and Kenya than would be expected). This study was interested in the relationships between behaviours, attitudes, and beliefs *across all road users* of a particular country context, and how they might differ *between countries*; as such, respondent groupings were based only on geographical location (i.e., the country in which they completed the questionnaire), not on road user type. We accept that this method has its limitations (see discussion section, below, for further treatment of this issue).

There were also differences between the countries in terms of exposure to the road system, or the number of hours respondents spent travelling each week. Table 5 summarises the responses across the six countries. A Kruskall-Wallis test revealed the differences between groups to be statistically significant ($\chi^2_{(5)} = 81.8$, $p < .001$). This was therefore included in subsequent analyses as a covariate.

Table 4. Responses to the question asking about respondents' primary (most commonly used) mode of transport, across the six countries. Percentages are with respect to the 3410 respondents who answered this question.

	Bangladesh	China	Kenya	Thailand	UK	Vietnam	*Totals*
Car driver	10 (2%)	307 (56%)	103 (21%)	228 (73%)	374 (54%)	91 (11%)	*1113 (33%)*
Bus or train passenger	115 (22%)	104 (19%)	270 (54%)	38 (12%)	112 (16%)	44 (5%)	*683 (20%)*
Motorcycle rider	35 (7%)	15 (3%)	9 (2%)	17 (5%)	19 (3%)	556 (67%)	*651 (19%)*
Pedestrian	19 (4%)	27 (5%)	53 (11%)	2 (<1%)	77 (11%)	42 (42%)	*220 (7%)*
Cyclist	49 (9%)	29 (5%)	7 (1%)	0 (0%)	72 (11%)	62 (7%)	*219 (6%)*
Car passenger	48 (9%)	56 (10%)	43 (9%)	19 (6%)	23 (23%)	10 (1%)	*199 (6%)*
Motorcycle passenger	31 (6%)	0 (0%)	1 (<1%)	9 (3%)	3 (<1%)	25 (3%)	*69 (2%)*
Other (passenger or driver)	223 (42%)	6 (1%)	14 (3%)	1 (<1%)	7 (1%)	5 (<1%)	*256 (8%)*
Totals	*530 (16%)*	*544 (16%)*	*500 (15%)*	*314 (9%)*	*687 (20%)*	*835 (24%)*	*3410 (100%)*

Table 5. Responses to the question asking about respondents' time spent travelling each week, across the six countries. Percentages are with respect to the 3421 respondents who answered this question.

	Bangladesh	China	Kenya	Thailand	UK	Vietnam	*Totals*

Less than 1 hour	42 (8%)	29 (5%)	60 (12%)	55 (17%)	17 (2%)	28 (3%)	*231 (7%)*
1 to 3 hours	119 (22%)	84 (15%)	131 (26%)	96 (30%)	138 (20%)	95 (11%)	*663 (19%)*
3 to 6 hours	126 (24%)	108 (20%)	96 (19%)	46 (15%)	228 (33%)	253 (30%)	*857 (25%)*
6 to 10 hours	103 (19%)	153 (28%)	96 (19%)	41 (13%)	162 (23%)	242 (29%)	*797 (23%)*
10 to 15 hours	63 (12%)	112 (21%)	60 (12%)	32 (10%)	82 (12%)	110 (13%)	*459 (13%)*
15 to 20 hours	19 (4%)	35 (6%)	25 (5%)	25 (8%)	30 (4%)	107 (13%)	*241 (7%)*
More than 20 hours	59 (11%)	23 (4%)	32 (6%)	22 (7%)	37 (5%)	0 (0%)	*173 (5%)*
Totals	*531 (16)*	*544 (16%)*	*500 (15%)*	*317 (9%)*	*694 (20%)*	*835 (24%)*	*3421 (100%)*

4. Results

4.1 Pedestrian behaviours and attitudes to road safety

To arrive at scores for pedestrian behaviours and attitudes for each respondent, a mean score of the items within each sub-scale was calculated. Regarding pedestrian behaviours, each factor contained four items, with factor scores having a possible range of one to six, with higher scores indicating more risky or dangerous behaviours. For attitudes to road safety, the mean of the 13 items arrived at a score for each respondent that could range from one to five, with higher scores representing safer attitudes. Table 6 presents the means and standard deviations for each of the three behavioural factors (see McIlroy et al., 2019, for more details) and one attitudinal factor. Cronbach alpha values are also presented; these give an indication of each of the five factors' internal consistency or reliability, with values over .7 generally considered to be acceptable (e.g. Nunally, 1978). Although alpha was below this .7 threshold for the violations sub-scale, it was considered sufficiently close (at 0.69) to warrant inclusion in subsequent analyses. The reader is advised, however to interpret results with a higher degree of caution.

Table 6. Means, standard deviations, and Cronbach alpha values for the behavioural and attitudinal factors included in analyses.

	Violations		Aggressions		Lapses		Attitudes	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Bangladesh	3.12	1.12	1.48	0.79	2.08	0.82	3.51	0.52
China	2.18	0.97	1.75	0.97	2.06	0.93	4.04	0.42
Kenya	2.58	1.03	1.84	0.86	1.95	1.03	4.15	0.63
Thailand	2.24	0.72	1.48	0.67	1.55	0.69	3.68	0.57
UK	2.66	0.81	1.69	0.80	1.70	0.84	3.84	0.58
Vietnam	2.36	0.83	1.48	0.79	2.08	0.82	3.51	0.52
Cronbach's Alpha	.69		.79		.85		.81	

4.2 Confirming the factor structure of the Fatalistic Belief questionnaire

1   As the multi-dimensional fatalism scale had yet to be applied in a cross-cultural setting

2   (to our knowledge) its factor structure was first tested using Confirmatory Factor Analysis

3   (CFA) in AMOS, using all countries' data together. Due to technical issues in the Kenya

4   sample, responses to one of the questions in Esparza et al.'s (2015) measure (question five;

5   'Everything that happens is part of God's plan') were not recorded. As such, this question

6   was excluded from all analyses, for all countries. This CFA revealed five items to have factor

7   loadings lower than the suggested 0.5 threshold (e.g., Hulland, 1999; Chen & Tsai, 2007;

8   Truong & McColl, 2011); these items were removed, and the analysis run again. Although

9   the comparative fit index (CFI) and Tucker-Lewis Index (TLI) were both slightly below the

10   suggested .95 thresholds discussed by Hooper et al. (2008) (at .92 and .91), adjusted

11   goodness-of-fit exceeded the suggested .90 threshold (at .91), and the root mean squared

12   error of approximation (RMSEA) and standardised root mean square residual (SRMR)

13   indices satisfied Hu and Bentler's (1999) two-index presentation strategy (of having RMSEA

14   under .06 and a SRMR under .09), at .056 and .059, respectively. Model fit was therefore

15   considered acceptable.

16   Cronbach alpha values of the sub-scales were then calculated, for all data together, and

17   for each country sample individually. These were below the .7 threshold for the Helplessness

18   factor, at .69 across all countries together, and in four of the six countries individually (at .61,

19   .67, .64, and .60 in Bangladesh, China, Kenya, and Vietnam respectively). This factor was

20   therefore removed, and the CFA model run again. The resulting model is presented in Figure

21   1, with model fit indices in the figure caption. These indices showed better model fit

22   compared to the model including Helplessness, hence was also considered acceptable.
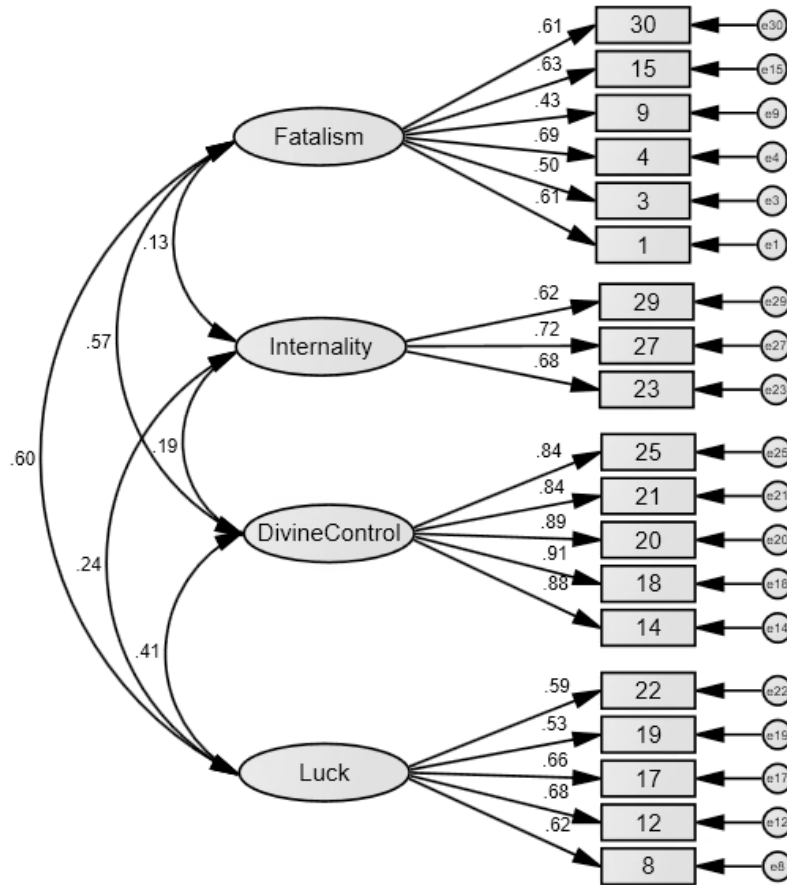
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Figure 1. Factor structure of the Fatalistic Beliefs scale, with item loadings and factor covariances displayed. $x^2/df = 11.8$, RMSEA = .057, CFI = .94, TLI = .93, GFI = .94, AGFI = .93 SRMR = .051 (Note: Hooper et al. (2008) suggest thresholds of: $x^2/df < 3$, RMSEA < .07, CFI > .95, TLI > .95, AGFI > .90, SRMR < .08). Item numbers indicate original question order.

Means and standard deviations of all items used in subsequent analyses are summarised in Table 7, along with Cronbach alpha reliability statistics, for each country individually, and all countries together. Table 8 displays means and standard deviations for each of the four factors, separated by country. Scores could range from one to five, with lower scores reflecting greater fatalistic tendencies, or stronger beliefs in external influences (internality questions were reverse coded such that high scores reflected a lower degree of internality, i.e., a more external locus of control). Although in the Kenya sample reliability values for the internality and luck factors were lower than the usually accepted .7 threshold (at .61 and .69 respectively), given good reliability across all other factors and countries (together and individually), the factor was retained for subsequent analyses. It is important to therefore interpret results for internality and luck in the Kenyan sample with caution.

Table 7. Means and standard deviations of all items included for analysis, and Cronbach alpha values for sub-scales, for all countries together (ac) and individually (Bd, Ch, Ke, Th, UK, Vn).

		M	SD
	General Fatalism (α: ac = .75, Bd = .74, Ch = .72, Ke = .71, Th = .70, UK = .80, Vn = .72)		
1	If bad things happen, it is because they were meant to happen	3.60	1.17
3	Life is very unpredictable, and there is nothing one can do to change the future	3.22	1.25
4	If something bad is going to happen to me, it will happen to me no matter what I do	3.45	1.18
9	There is no sense in planning a lot; if something good is going to happen, it will	3.71	1.07
15	People die when it is their time to die and there is not much that can be done about it	3.13	1.39
30	I have learned that what is going to happen will happen	2.95	1.19
	Internality (α: ac = .71, Bd = .72, Ch = .712, Ke = .61, Th = .92, UK = .72, Vn = .70)		
23	What happens to me in the future mostly depends on me	3.98	.95
27	My life is determined by my own actions	4.06	.87
29	I feel that when good things happen, they happen as a result of my own efforts	3.89	.94
	Divine Control (α: ac = .94, Bd = .88, Ch = .84, Ke = .83, Th = .95, UK = .96, Vn = .91)		
14	Everything that happens to a person was planned by God	3.50	1.38
18	Whatever happens to me in my life, it is because God wanted it to happen	3.52	1.37
20	God controls everything good and bad that happens to a person	3.50	1.40
21	God has a plan for each person, and you cannot change His plan	3.48	1.41
25	No matter how much effort I invest into doing things, in the end, God's decision will prevail	3.47	1.40
	Luck (α: ac = .75, Bd = .76, Ch = .72, Ke = .69, Th = .80, UK = .75, Vn = .71)		
8	When good things happen to people, it is because of good luck	3.30	1.07
12	When I get what I want, it's usually because I am lucky	3.68	1.02
17	The really good things that happen to me are mostly because of luck	3.61	1.05
19	Some people are simply born lucky	2.82	1.26
22	How successful people are in their jobs is related to how lucky they are	3.55	1.14

Table 8. Means and standard deviations for the four fatalistic belief factors included in the analyses, by country sample.

	Fatalism		Internality		Divine Control		Luck	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Bangladesh	2.81	0.93	3.93	0.77	2.03	1.10	2.76	0.90
China	3.72	0.62	3.72	0.61	4.03	0.71	3.30	0.64
Kenya	3.50	0.88	3.88	0.75	2.42	1.08	3.59	0.76
Thailand	3.03	0.67	4.18	0.71	4.20	0.85	3.43	0.64
UK	3.59	0.72	3.67	0.55	4.12	1.03	3.49	0.62
Vietnam	3.26	0.63	3.94	0.46	3.92	0.74	3.06	0.54

4.3. The effect of beliefs on attitudes and behaviours

To assess the extent to which the four fatalistic belief factors account for variance in road safety attitudes and self-reported pedestrian behaviours over and above the effects of age, gender, primary transport mode choice, and the number of hours spent travelling (exposure) each week, four hierarchical linear regression analyses (enter method) were performed on the full data set (i.e., all six countries together); one for attitudes, and one for each of the three pedestrian behaviour factors (violations, aggressions, lapses). To assess the beliefs' influence over road safety attitudes, age and gender were entered into the first block, primary mode choice and exposure in the second, and fatalistic beliefs in the third. For the three behavioural factors, blocks one and two were as above, the third block included road

safety attitudes, and the fourth included the fatalistic belief factors. Results of the four analyses are presented in Tables 9 and 10. All adjusted R squared values and all changes in R squared were found to be significant at the $p < .001$ level. Regression weights for individual variables arising from these regression models are not presented here; this is for brevity, and for the reason that individual weights were analysed in more detail using a structural equation modelling approach (below), without the inclusion of primary transport mode in the analysis (i.e., relationships between beliefs, attitudes, and behaviours were explored across all road users in each country context).

Table 9. The effects on road safety attitudes of age and gender, mode choice and exposure, and fatalistic beliefs (adjusted R squared). All values rounded to two decimal places.

	Adj. R^2	ΔR^2
Step One: Age and gender	.01	
Step Two: Primary transport mode and exposure	.07	.06
Step Three: Fatalistic beliefs	.21	.14

Table 10. The effects on self-reported pedestrian behaviours of age and gender, mode choice and exposure, road safety attitudes, and fatalistic beliefs (adjusted R squared). All values rounded to two decimal places.

	Violations		Aggressions		Lapses	
	Adj. R^2	ΔR^2	Adj. R^2	ΔR^2	Adj. R^2	ΔR^2
Step One: Age and gender	.03		.01		.03	
Step Two: Transport mode and exposure	.07	.04	.03	.02	.05	.02
Step Three: Road safety attitudes	.14	.07	.06	.04	.10	.05
Step Four: Fatalistic beliefs	.17	.03	.10	.04	.13	.03

4.4. Testing relationships between factors

To investigate further the effects of the individual fatalistic belief factors on road safety attitudes and self-reported pedestrian behaviours, and how these relationships differ across countries, a structural equation modelling approach was considered appropriate. This approach allows for the simultaneous assessment of all the paths included in the models tested, and provides a means to assess to what extent the effect of fatalistic beliefs on behaviours is mediated through road safety attitudes, or is direct.

The causal steps approach to mediation analysis, outlined by Baron and Kenny (1986), posits that the relationship between an independent and a dependent variable should be tested

1 both before and after the inclusion of a mediating variable. With the mediating variable

2 included, direct and indirect effects can then also be tested. In Figure 2, a simplified

3 mediation model, path *c* represents the 'total' effect of variable *x* on variable *y* (without the

4 mediating variable present), path *c'* is the 'direct' effect, path *a* is the effect of the variable *x*

5 on the mediator (*m*), and path *b* the effect of *m* on *y*. Finally, the 'indirect' effect of variable *x*

6 on *y* is the product of *a* x *b*. This indirect effect can then be tested for statistical significance

7 using bootstrapping in SEM software (e.g., AMOS). Although Baron and Kenny (1986)

8 suggested mediation analysis should only proceed if path *c* is statistically significant (i.e.,

9 there is an effect to be mediated), more recent work suggests that this condition is not

10 necessary, and that each effect is worthy of investigation in its own right, with or without the

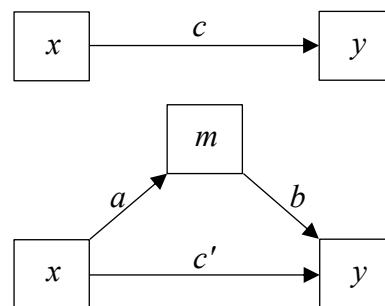11 presence of other effects (Hayes, 2009; Rucker et al. 2011).

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19 Figure 2. Simplified mediation model.

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21 To assess mediation in the context of fatalistic beliefs, attitudes to road safety, and pedestrian

22 behaviour factors, multi-group path analysis was performed in AMOS. This multi-group

23 approach allows for the separation of the data set into groups (in this case, country) when

24 assessing a single model (in this case, one for each pedestrian behaviour factor). This allows

25 for the assessment of the extent to which the various relationships represented in the models

26 were moderated by country, and whether mediation through attitudes was moderated by

27 country. To perform such an investigation, three separate multi-group path analyses were

28 conducted; one for each behavioural factor (i.e., violations, aggressions, and lapses). In each

29 of the three multi-group models, there were six groups; one for each of the six countries

30 included in the investigation.

31   The model presented in Figure 3 (below) provides a simplified representation of the

32 three models tested. In place of behaviour' in Figure 3, one model had 'violations', the

33 second had 'aggressions', and the third had 'lapses'. Although not represented in Figure 3

34 (for reasons of neatness and legibility), in all three multi-group models age, gender, and

1   exposure to the road system (i.e., number of hours spent travelling each week) were included

2   as covariates. These were treated as exogenous variables, with directional paths linking them

3   to the endogenous variables of attitudes and behaviour (violations, aggressions, or lapses in

4   models one, two, and three). They were also covaried with all other exogenous variables (i.e.,

5   with the four fatalistic belief factors and with each other). All three of these variables were

6   found to be significantly related to road safety attitudes and self-reported pedestrian

7   behaviour (see the regression analysis, above). Their inclusion as covariates in the models

8   allowed for the interpretation of the unique effects of fatalistic beliefs on road safety attitudes

9   and self-reported pedestrian behaviours over and above the effects of age, gender, and

10 exposure. As described above (in section 3.2), primary transport mode was not included in

11 this analysis (see also limitations, Section 6, below).

12   The three multi-group path analyses were each run with and without the attitudes

13 node included (representing the top and bottom parts of the simplified model in Figure 2,

14 above) in order to calculate total, direct, and indirect effects of fatalistic beliefs on self-

15 reported pedestrian behaviours. The bootstrapping technique was used to test the statistical

16 significance of the indirect effects of fatalistic belief on self-reported behaviour, with 5000

17 random samples and a 95% confidence interval (calculated in AMOS). This also allowed for

18 a test of statistical significance of the total proportion of variance explained in the self-

19 reported behaviour and attitude scores (i.e., equivalent to R^2 in regression). Results of the

20 SEM are presented in Tables 11 to 13, separated by country and by pedestrian behaviour
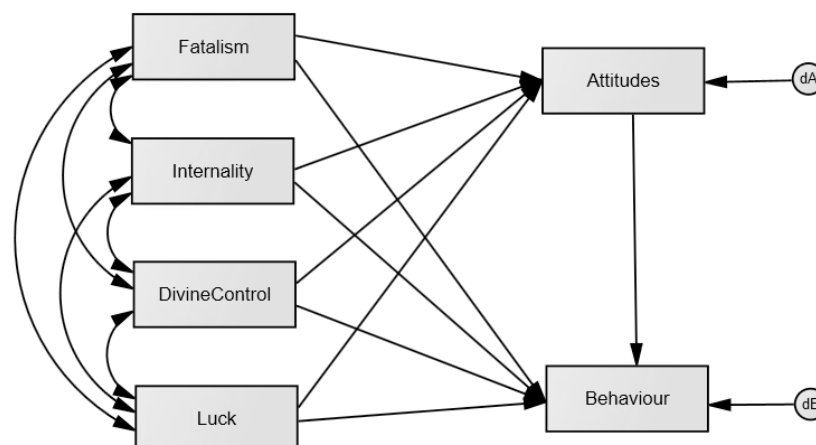
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24 Figure 3. Structural model used to test for significant pairwise differences in regressions weights, for
25 mediation, and for differences in mediation across countries (age and gender were also included in the
26 models; see text for explanation). The 'Behaviour' node was substituted for the specific behavioural
27 factor of interest in each model (i.e., violations, aggressions, lapses).

Table 11. SEM Results: Standardised regression weights in the three multi-group models, including total effects of the fatalistic belief factor on the behaviour (i.e., models tested without attitudes included), and both direct and indirect effects of beliefs on behaviours (with the attitudes mediator included; see Figure 2 explanation, above). Standardised regression weights indicating the extent to which attitudes scores influence each of the three behavioural factors also included. All weights rounded to two decimal places with the exception of indirect effects, rounded to three decimal places (as all were under .1). Effects of age, gender, and exposure are also included.

Model	Effects	Bangladesh			China			Kenya			Thailand			UK			Vietnam		
		Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect
One: Violations	General Fatalism	-.24***	-.19**	-.049***	-.05	-.02	-.031*	-.12*	-.09	-.034**	-.12*	-.08	-.041*	.11*	.16***	-.047***	-.14***	-.11**	-.038**
	Internality	.01	.02	-.015*	-.27***	-.24***	-.037***	-.10*	-.09*	-.007	-.21***	-.19***	-.018	-.06	-.05	-.014	-.20***	-.16***	-.043***
	Divine Control	.06	.04	.028**	-.17**	-.15**	-.015	.15**	.14**	.013*	-.16**	-.11	-.054**	-.09*	-.08	-.008	-.06	<.01	-.064***
	Luck	-.02	.02	-.031***	-.02	.02	-.038**	-.05	-.04	-.012*	-.11	-.04	-.071***	-.17***	-.10*	-.067***	-.04	.01	-.046***
	Age	-.15***	-.14**	-.011	-.08*	-.08*	.001	-.15**	-.13**	-.018*	-.12*	-.07	-.045**	-.21***	-.16***	-.057***	-.13***	-.10**	-.031**
	Gender	.07	.06	.006	.08	.05	.029**	.02	<.01	.019**	.10	.05	.046**	.07	.06	.012	.09*	.06	.029*
	Exposure	-.04	-.06	.023**	-.07	-.05	-.029**	-.09*	-.09*	.001	-.12**	-.11*	-.008	.03	<.01	.027*	.02	.01	.009
	Attitudes		-.16***			-.26***			-.12**			-.31***			-.31***			-.36***	
Two: Aggressions	General Fatalism	-.071	<.01	-.072***	-.08	-.06	-.025*	-.10	-.07	-.028*	-.08	-.05	-.030*	-.10*	-.08	-.025***	-.04	-.02	-.018**
	Internality	-.18***	-.15***	-.022*	-.37***	-.34***	-.030***	-.05	-.05	-.006	-.27***	-.26***	-.013	-.08*	-.07	-.007	-.24***	-.22***	-.020***
	Divine Control	.29***	.25***	.041**	-.12*	-.11*	-.012	.11*	.10*	.011*	-.15*	-.11	-.039**	-.01	-.01	-.004	-.10*	-.07	-.030***
	Luck	-.14**	-.10	-.045***	.06	.09*	-.031**	-.10*	-.09*	-.010*	.05	.10	-.051***	-.12**	-.09*	-.036***	-.01	.02	-.022***
	Age	-.12**	-.11*	-.016	.02	.02	.001	-.16***	-.14**	-.015*	-.04	<.01	-.032**	-.10**	-.07	-.030***	-.03	-.01	-.015**
	Gender	.09*	.08	.009	.07	.05	.024**	.09*	.08	.016*	.07	.04	.033**	.11**	.11**	.006	.07*	.06	.014**
	Exposure	.12**	.09*	.033***	-.10*	-.07	-.024**	-.07	-.08	.001	-.01	<.01	-.006	.08*	.07	.015*	.02	.01	.004
	Attitudes		-.24***			-.21***			-.10*			-.22***			-.16***			-.17***	
Three: Lapses	General Fatalism	-.14*	-.09	-.058***	.05	.08	-.035*	-.03	-.01	-.020	-.15*	-.12	-.029*	.01	.04	-.034***	-.06	-.04	-.021**
	Internality	-.05	-.03	-.018*	-.28***	-.24***	-.042***	-.02	-.02	-.004	-.27***	-.26***	-.012	-.08*	-.07	-.010	-.17***	-.15***	-.024***
	Divine Control	.20***	.17**	.033**	-.16**	-.15**	-.017	.10*	.10*	.008	-.12	-.08	-.038**	-.18***	-.18***	-.006	-.08	-.04	-.036***
	Luck	-.11*	-.07	-.036***	-.11*	-.06	-.043**	-.11*	-.10*	-.007	-.01	.04	-.050***	-.15***	-.10*	-.049***	-.06	-.03	-.026***
	Age	-.05	-.04	-.013	-.08*	-.08*	.001	-.22***	-.21***	-.010	-.09	-.06	-.032**	-.21***	-.16***	-.042***	-.11***	-.09**	-.017**
	Gender	.14**	.13**	.008	.02	-.01	.033**	.01	<.01	.011	.06	.03	.032**	.01	<.01	.009	.07*	.06	.017**
	Exposure	-.04	-.07	.027***	-.03	.01	-.033**	-.14**	-.14**	.001	-.04	-.04	-.006	.05	.03	.020*	-.01	-.02	.005
	Attitudes		-.19***			-.20***			-.07			-.22***			-.23***			-.20***	

*** $p < .001$., ** $p < .01$, * $p < .05$ (two-tailed).

Table 12. SEM Results: Squared multiple comparisons showing the total amount of variance in self-reported pedestrian behaviour explained in each of the three multi-group models tested (equivalent to R^2).

	Bangladesh	China	Kenya	Thailand	UK	Vietnam
Violations	.09*	.24*	.08*	.27*	.17**	.23**
Aggressions	.15*	.26**	.09*	.16*	.10**	.12**
Lapses	.08*	.24**	.10*	.19*	.19**	.12**

*** $p < .001.$, ** $p < .01$, * $p < .05$ (two-tailed).

Table 13. SEM Results: Squared multiple comparisons (R^2) and standardised regression weights indicating the total amount of variance explained in attitudes score, and the extent to which each of the fatalistic belief factors individually influences attitudes scores. Note that these values were identical in the each of the three multi-group models tested, hence are presented in one table here. Effects of age, gender, and exposure on attitudes are also included.

	Bangladesh		China		Kenya		Thailand		UK		Vietnam	
	R^2	β	R^2	β	R^2	β	R^2	β	R^2	β	R^2	β
	.17**		.14**		.14**		.24**		.17**		.16**	
General Fatalism		.31***		.12*		.27***		.13*		.15***		.11**
Internality		.10*		.14***		.06		.06		.05		.12***
Divine Control		-.17**		.06		-.11*		.17**		.03		.18***
Luck		.19***		.15**		.10*		.23***		.22***		.13***
Age		.07		<.01		.14***		.15**		.19***		.09**
Gender		-.04		-.11**		-.16***		-.15**		-.04		-.08*
Exposure		-.14***		.11**		-.01		.03		-.09*		-.03

*** $p < .001.$, ** $p < .01$, * $p < .05$ (two-tailed).

5. Interpretation of SEM results

Tables 11 to 13 display a variety of significant effects across the behavioural and belief factors, and across the six countries. Regarding effect sizes, we follow Cohen's (1988) standards of .1 for small, .3 for medium, and .5 for large. As the indirect effects are the product of two effects, these effect size values are squared; .01 for a small effect, .09 for medium, and .25 for large. Following Rucker et al. (2011) we do not discuss mediation as 'full' or 'partial' (with those authors arguing the terms to have limited usefulness or meaning); rather, we simply draw attention to where relationships between fatalistic beliefs and attitudes were significant or not, and where relationships between fatalistic beliefs and self-reported pedestrian behaviours were significant or not, with or without inclusion of road safety attitudes as a mediator.

With the exception of lapses in Kenya, in all countries and for all behavioural factors, the path from attitudes to behaviour was found to be significant. In most cases, the effects

were small to medium; in all cases, more dangerous attitudes were linked with the reporting of more risky behaviours. The relationships between attitudes and behaviours, and the country differences therein, are discussed in more detail elsewhere McIlroy et al. 2020). The following discussions focus on the effects of the fatalistic belief factors on road safety attitudes and self-reported pedestrian behaviours.

5.1 The effect of beliefs on attitudes

The effects of fatalistic beliefs on attitudes (Table 13) were repeated (i.e., identical) in the three SEM analyses, hence are discussed together here. A number of differences across the five factors and the six countries were observed. Overall, the total amount of variance in road safety attitudes explained by the four fatalistic belief factors, age, gender, and exposure to the road system ranged from 14% (in China and Kenya) to 24% (in Thailand).

The demographic factors were influential to different extents across the countries. Exposure (i.e., number of hours spent travelling each week) was significantly related to attitudes in Bangladesh and China only. Effect sizes were small in both cases, and in opposing directions (-.14 and .11 in Bangladesh and China respectively). In Bangladesh, more hours spent travelling was related to more dangerous attitudes to road safety; in China, the opposite was true. Age was influential in Kenya, Thailand, the UK, and Vietnam, though again effect sizes were small (at .09 in Vietnam) to small-to-medium (at .19 in the UK). In all cases, younger participants reported more dangerous attitudes to road safety. Gender was significantly related to attitude scores in China, Kenya, Thailand, and Vietnam, again with small effect sizes, and all in the same direction. As would be expected given existing literature, males reported more dangerous attitudes than females.

Taking the effects of age, gender, and exposure into account, the fatalistic belief factors showed a variety of significant relationships with road safety attitudes. In Bangladesh and Kenya, the general fatalism factor was found to be significantly linked with attitudes with medium effect sizes. In all other countries, relationships were significant but with small effect sizes. Higher degrees of general fatalism were linked with more dangerous attitudes to road safety. In Bangladesh, China, and Vietnam, internality was also significantly linked with attitudes (with more internally orientated individuals reporting safer attitudes), although effect sizes were small, at .10 to .14.

Regarding divine control, its effect on attitudes was found to be significant in four countries; Bangladesh, Kenya, Thailand, and Vietnam. Although effect sizes were again small (at .11 to .18), in Thailand and Vietnam, a greater belief in divine control was linked

1   with more dangerous attitudes, while in Bangladesh and Kenya the opposite was true; those

2   reporting greater belief in divine control also reported safer attitudes to road safety. There is

3   therefore good evidence to suggest that the relationship between a belief in divine influence

4   and a person's attitudes to road safety is moderated by country.

5   Regarding luck, effects on attitudes were found to be significant in all countries;

6   however, effects were small to medium or small (particularly in Kenya, at .10). In all cases, a

7   greater belief in luck was linked to more dangerous attitudes to road safety.

8   In summary, in all countries, at least one of the fatalistic belief categories accounted for

9   significant variability in road safety attitudes. They were not, however, the same variables in

10   each country, and, in the case of divine control, relationships were not always in the same

11   direction. There is therefore good evidence to suggest that the effect of fatalistic beliefs on

12   road safety attitudes is dependent on both the context of application, and on the specific facet

13   of fatalism of interest.

14

15   **5.2 Violations**

16   Given the marginally low internal reliability score for this factor (at $\alpha = .69$), results for

17   violations should be taken with a greater degree of caution; nevertheless, they are discussed

18   in full here. Taking the three demographic, five fatalistic belief, and one attitudes factors

19   together, between 8% (Kenya) and 27% (Thailand) of the variance in a respondents' self-

20   reported tendency to intentionally break rules as a pedestrian was explained (Table 12).

21   Looking at the individual regression weights in more detail (Table 11), a variety of effects

22   were seen for the three demographic factors and the five fatalistic belief factors. The

23   following discussions will focus on the unique effects of the fatalistic belief factors given

24   inclusion of the demographic factors as covariates in the model.

25   It can be seen that the total effects of the general fatalism factor (in the model without

26   attitudes included) were found to be significant in all countries except China, with the

27   strongest relationships in Bangladesh (at -.24) and Vietnam (at -.14). In all cases, effect sizes

28   were small to small-to-medium. The reader will note that in the UK the effect was in the

29   opposing direction (at .11) to all other countries. In Bangladesh (and all other countries to a

30   lesser extent), more fatalistic beliefs were linked with higher reporting of intentional rule

31   violations, whereas in the UK general fatalism was linked to lower violations scores. Upon

32   inclusion of attitudes as a mediator, in all countries except the UK the relationship between

33   general fatalism and violations was reduced, and the indirect effect found to be significant.

34   This suggests the presence of mediation through road safety attitudes in these settings. In the

1 UK, inclusion of the mediator resulted in an increased direct effect. This inconsistent

2 mediation (MacKinnon et al. 2007) arises from the opposing directions of the relationships

3 between beliefs and attitudes, and beliefs and behaviours, in this sample.

4   Regarding the effect of internality on violations, significant effects were found in

5 China, Thailand, and Vietnam (and, to a lesser extent, Kenya; though note that internal

6 reliability of the internality scale was low in the Kenya sample, at $\alpha = .61$). In all cases, a

7 more external orientation was linked with a higher reporting of intentional rule violations.

8 This direct effect of beliefs on behaviour remained in all three countries after inclusion of

9 attitudes as a mediator; the indirect effect was statistically significant in China and Vietnam.

10 In Bangladesh, although no total or direct effects were found, the significant indirect effect

11 suggest some mediation is present (though with a small effect size at .015). This suggests that

12 internality is directly linked to self-reported violation behaviours in Thailand, with no

13 mediation, while in China and Vietnam the fatalistic belief influence behaviour both directly

14 and indirectly, through attitudes. There is good evidence to suggest that mediation is

15 moderated by country for this variable.

16   The total effect of divine control scores on violation scores was significant in China,

17 Kenya, Thailand, and the UK, all with small effect sizes (-.09 to -.17). In most cases, a

18 greater belief in divine control over one's life was associated with the reporting of more rule

19 violations; in Kenya, those that reported stronger religious beliefs reported performing *fewer*

20 intentional rule violations. In all cases, upon inclusion of the attitudes mediator the effect of

21 divine control on violations was reduced; this indirect effect was significant in Bangladesh,

22 Kenya, Thailand, and Vietnam. In Bangladesh and Vietnam, only the indirect effect was

23 significant, suggesting divine control to be linked with attitudes but not violations. In

24 Thailand and the UK, significant total effects were rendered non-significant after the

25 inclusion of the attitudes mediator (indicating mediation), suggesting the effect of divine

26 control on violations to be mediated through attitudes. Although the indirect effect was

27 significant in the Kenya sample, it was very small (at .013). No significant indirect effect was

28 observed in China. This suggests a belief in a divine power to have a direct effect on

29 intentional rule violations not mediated by attitudes in these two settings.

30   In all countries except the UK, no total or direct relationships were found between a

31 belief in luck and the self-reported tendency to intentionally violate rules as a pedestrian.

32 Indirect effects were, however, found in all of these cases, suggesting a belief in luck to

33 influence this behavioural factor through its influence on attitudes

34

5.3 Aggressions

Looking at the overall effects on aggressions of the independent variables included in the model tested, between 9% (Kenya) and 26% (China) of the variance could be explained. In terms of the specific factors, general fatalism was directly linked with aggression scores only in the UK, though this was significant only at the $p < .05$ level, and with a small effect size (at .01). In all countries, the indirect effect was significant, with effects ranging from small (at .018 in Vietnam) to medium (at -.072 in Bangladesh). This suggests general fatalism to affect the self-reported tendency to perform aggressive pedestrian behaviours via its link with attitudes only, not directly.

For the link between internality and aggression scores, similar results were seen in Bangladesh, China, Thailand, and Vietnam. Total effects of the belief on the behaviour were significant, as were the direct effects (once the mediator had been included in the model). The indirect effect was also significant in all these countries with the exception of Thailand, though in all cases the effect size was small (with -.030, in China, being the largest β value). In Kenya, no significant effects were found, while in the UK, only the total effect was statistically significant (though at only the $p < .05$ level, and with a small effect size of .08). Taken together, results suggest that a tendency to view events as externally driven is linked with the reporting of more aggressive pedestrian behaviours in the Bangladesh, China, Thailand, and Vietnam samples, but not in the Kenya or the UK samples. There was some evidence for mediation through attitudes of this effect in China and Vietnam (where stronger indirect effects were seen), but not in other settings, suggesting mediation to be moderated by country.

The effects of divine control on aggressions depended on country. In Bangladesh and Kenya, a greater belief in divine influence over one's life was linked with the reporting of fewer aggressive pedestrian behaviours. The indirect effect was significant in both cases, suggesting some level of mediation; however, the direct effect of belief on behaviour was stronger (particularly in Bangladesh). This suggests that divine control beliefs both directly and indirectly affect the self-reported tendency to perform aggressive pedestrian behaviours. In China, Thailand, and Vietnam the opposite relationship was found; i.e., that those reporting greater belief in divine influence reported performing more aggressive behaviours. In Vietnam and Thailand the total effects were rendered insignificant upon inclusion of the attitude mediator, and the indirect effects was found to be significant; this suggests the effect of divine control on aggressions to be mediated through attitudes. Together, results suggest that the relationship between a belief in divine control is moderated by country, and that this

1 relationship is mediated by attitudes to a greater or lesser extent, depending on the country

2 sample under analysis.

3   Results for the effect of luck on aggressions were mixed. In Bangladesh, a significant

4 total effect was rendered insignificant after inclusion of the attitudes mediator, suggesting this

5 belief factor to affect self-reported aggressive pedestrian behaviour through attitudes only,

6 not directly. In China, a non-significant total effect became a significant direct effect after

7 attitudes were included; this suggest attitude to have a supressing effect on that relationship.

8 Although those reporting greater belief in luck also reported more dangerous attitudes to road

9 safety, they had a tendency to report performing fewer aggressive behaviours (though effect

10 sizes were small, with β values of .09 for the direct effect and -.031 for the indirect effect). In

11 Kenya and the UK, all three effects (total, direct, indirect) were statistically significant,

12 suggesting a belief in luck to be linked with the self-reported performance of aggressive

13 behaviours both directly and indirectly, through attitudes. In both cases, a greater belief in

14 luck was associated with the reporting of more dangerous behaviours and attitudes (though

15 effect sizes were also small). Finally, in Thailand, only the indirect effect was significant,

16 likely an artefact of the stronger relationship between luck and attitudes scores.

17

18 **5.4 Lapses**

19   Across countries, the extent to which variance in memory and attention errors was

20 explained by the demographic and fatalistic belief factors included in the models ranged from

21 8% (in Kenya) to 24% (in China). The general fatalism factor was found to have a significant

22 effect on lapses in few cases. Only in Bangladesh and Thailand were direct or total effects

23 found to significant, while significant indirect effects were found in all countries except

24 Kenya. This is likely to be a result of the stronger relationship this fatalistic belief factor has

25 with road safety attitudes across country samples.

26   Internality was shown to have differing effects on behaviour depending on country. In

27 Bangladesh, Kenya, and the UK, few significant effects were found, with those that did attain

28 significance only doing so at the $p < .05$ level, with low effect sizes. In China and Vietnam,

29 the effect of internality on lapses was both direct and mediated through attitudes, whereas in

30 Thailand the effect was only direct (with no mediation). These results suggest that a feeling

31 of having personal control over events in one's life is directly associated with the reporting of

32 fewer memory or attention errors as a pedestrian in China, Thailand, and Vietnam, but not in

33 Bangladesh, Kenya, or the UK, and that the mediating effect of road safety attitudes on this

34 relationship is dependent on the country sample under analysis.

The effect of divine control on lapses also differed across the countries. In China and the UK, results suggest the effect to be direct, with no mediation through attitudes; those reporting a greater belief in divine influence also report performing more memory and attention errors as a pedestrian. In Bangladesh and (to a lesser extent) Kenya, these relationships were in the opposite direction, with stronger divine control beliefs linked with greater self-reported lapses. The indirect effect was also significant in Bangladesh, suggesting some mediation through attitudes. In Thailand and Vietnam, only the indirect effects were found to be significant, likely an artefact of the relationship between attitudes and lapse scores. As such, there is data to suggest the effect of divine control on lapses to be moderated by country, but there is little strong evidence for mediation.

Results indicated the influence of luck on lapses to be mediated by attitudes particularly in Bangladesh and China, where a significant total effect was rendered non-significant upon inclusion of the mediator; the significant indirect effects were small-to-medium (at -.036 and -.043) in effect size. A similar pattern was seen for the UK group, though the direct effect of luck on lapses remained significance at the $p < .05$ level (with a value of -.10). In Kenya, total and direct effects were significant (at the $p < .05$ level), and the indirect insignificant. This suggest the effect of luck on lapses to be direct and not mediated through attitudes; however, effect sizes were small (at -.11 and -.10 for total and direct effects). Finally, in Thailand and Vietnam, only the indirect effects were found to be statistically significant, suggesting luck to be related only to attitudes, not to lapses. In all cases where significant effects were seen, a greater belief in luck was linked with the self-reported performance of more memory and attention errors as a pedestrian.

6. Discussion

This study has presented an application of a multidimensional, self-report measure of fatalistic beliefs across six countries, and explored the impact these beliefs have on road safety attitudes and three classes of pedestrian behaviours, namely intentional rule violations, aggressive behaviours, and attention or memory errors. Regression analyses showed fatalistic beliefs to explain significant additional variance in road safety attitudes over and above age, gender, transport mode choice, and exposure to the road system; they also showed these types of beliefs to explain significant additional variance in self-reported pedestrian behaviours over the demographic factors and attitudes to road safety (which themselves explained significant variance in behaviours).

1   A wide variety of significant differences were found across countries and, for a number

2 of the measures included above, there was evidence for the existence of different

3 relationships between beliefs, attitudes, and behaviours in different countries. Additionally,

4 the effects of fatalistic beliefs on attitudes and behaviours strongly depended on the

5 dimension of fatalism under analysis. Results from the structural equation modelling (SEM)

6 suggest the existence of different models in each country, and for each behavioural factor. As

7 such, there could be up to 18 distinct models; one for the prediction of each of the three

8 behaviours in each of the six countries. These would need to be tested with new data to

9 confirm. Overall, and as Esparza et al. (2015) argued, although the different fatalism concepts

10 are related, they are not the same; our results support this, indicating that the concepts have

11 different effects on people's attitudes to road safety, and on their self-reported behaviours.

12   In terms of the three behavioural factors assessed, namely aggressions, violations, and

13 lapses, although differences in the nature of the relationships were found (in terms of the

14 specific explanatory factors exerting most influence, or the country under investigation), the

15 three factors were comparable in terms of the extent to which variance was explained in the

16 analyses presented above; between 9% and 26% (aggressions), 8% and 24% (lapses), and 8%

17 and 27% (violations) of the variance in self-reported behaviour was explained by age, gender,

18 attitudes, and beliefs. In other words, attitudes and beliefs influence the extent to which

19 people report performing aggressive behaviours, intentional rule violations, *and* unintentional

20 memory or attention errors. Although the latter of these three factors may seem somewhat

21 distinct to the former two (unintentional vs. intentional), our results do not suggest lapses to

22 be any less related to beliefs or attitudes. This is contrast to previous work (e.g., Ma et al.

23 2010, Lucidi et al. 2014; Mallia et al 2015) where attitudes more strongly related to self-

24 reported intentional violations than they do to unintentional errors.

25   Looking into the nature of the relationships between the factors explored, it can be seen

26 that the demographic factors had varying influences on behaviours and attitudes across the

27 different countries. Where significant effects were found for age and gender, they were in the

28 expected direction; younger respondents and male respondents reported holding more

29 dangerous attitudes to road safety, and reported performing more dangerous pedestrian

30 behaviours. Regarding exposure, or the number of hours spent using the transport system

31 each week, this was significantly related to attitudes and behaviours, though to different

32 extents in the different country samples. In most cases where statistically significant effects

33 were seen, a greater time spent travelling each week was associated with more dangerous

34 attitudes to road safety and the reporting of more risky behaviours, with the single exception

1 of self-reported aggressive behaviours in the UK sample (though the effect size was small, at

2 a β of .08). In all cases, effects were small, with the largest regression weight being .14 in

3 Bangladesh for the association with attitudes (note Cohen's effect size standards of .1 for

4 small, .3 for medium, and .5 for large).

5   Looking beyond demographics, one consistent finding was that a person's attitudes to

6 road safety is significantly linked with their self-reported behaviour as a pedestrian, for all

7 factors in almost all countries except Kenya (where much weaker relationships were found).

8 It is beyond the scope of the current paper to discuss this at length (we do so elsewhere;

9 McIlroy et al. 2020); more pertinent to the current study were the variety of effects of

10 fatalistic beliefs on those attitudes, and the direct and indirect effects of those beliefs on the

11 three classes of self-reported pedestrian behaviours, namely violations (intentional rule

12 breaking), aggressions (aggressive behaviours), and lapses (memory and attention errors).

13   In the introduction, no specific hypotheses were formulated with respect to the

14 relationship between beliefs and attitudes; however, it was argued that it could be reasonably

15 expected, given research linking fatalistic beliefs and on-road behaviours, and research

16 linking on-road behaviours and road safety attitudes, that fatalistic beliefs would be linked

17 with road safety attitudes. This was indeed found for a number of the fatalism factors, though

18 not all; results were quite different for the different factors. One commonality across most

19 countries was the effect of general fatalistic beliefs on road safety attitudes. This belief, the

20 core fatalistic idea that events are fixed in advance and are inevitable, was associated with

21 having more dangerous attitudes to road safety. Another consistent finding across country

22 samples was the influence of a belief in luck; in all countries, a stronger sense that life is

23 controlled by accidental happenings, with some people being luckier than others, was linked

24 with more dangerous attitudes to road safety. Results for the effect of internality on attitudes

25 was not consistent across country sample. In the Bangladesh, China, and Vietnam samples,

26 those with a more external locus of control expressed more dangerous attitudes to road

27 safety; in Kenya, Thailand, and the UK, no significant effects were seen. That said, even

28 where statistically significant relationships were found, effect sizes were low.

29   The most notable between-country differences in the attitudes-beliefs link were found

30 for the divine control factor. No relationships were found in China, Kenya, or the UK,

31 whereas relationships in opposing directions were found in Bangladesh compared to Thailand

32 and Vietnam. Just as Yıldırım (2007) and Nabipour et al. (2015) found, in the almost entirely

33 Muslim, Bangladeshi sample, a belief in divine influence over one's life had a protective

34 effect, being linked with safer attitudes to on-road actions and behaviours. In Thailand and

Vietnam, countries with no monotheistic tradition, these kinds of beliefs were linked with more dangerous road safety attitudes. Nabipour et al.'s (2015) finding was in relation to adolescent road user behaviours, with religiosity measured in terms of engagement in religious activities. Esparza et al.'s (2015) measure asks about fundamental beliefs in the influential power of God in one's life, not the engagement in specific activities, hence the two measures are somewhat distinct; nevertheless, the findings are in agreement. In addition to describing the benefit of attending supportive religious institutions, Nabipour and colleagues explained their results in terms of the values encouraged by Islam, namely respect for law and the rights of others, patience, and charity. This latter explanation could also apply to the relationship found in our results.

In terms of the effects of belief factors on pedestrian behaviours, results for divine control are again of particular interest given the differences across countries. For example, in China and the UK, a stronger belief in God's influence over one's life was directly linked with increased reports of inattention or memory errors (lapses); in Bangladesh, the opposite was found, with religiosity again having a protective effect. This was also found for the aggressions scale. In Bangladesh, those reporting stronger beliefs in God's influence also reported performing fewer aggressive behaviours. We would apply the same explanation as above to these results; data suggests Islam to serve a protective function with regard to pedestrian behaviours. Results from the Kenyan sample mirrored those seen in the Bangladesh sample, though to a lesser extent (i.e., with smaller effect sizes).

Results from the violations scale, that which asks about intentional rule violations, were similar. Although no links were found in the Bangladesh sample (where data suggest religious beliefs play no significant role), links were found in the Kenya, China, and Thailand samples, with relationships again differing across nations. In Kenya, the beliefs had a direct, positive role; those more strongly believing in God's influence also reported performing fewer intentional pedestrian rule violations. In China, the opposite was true. This was similar in Thailand, but the relationship was found to be strongly mediated by attitudes.

Given the parallels between certain groups of countries, our results suggest that the observed differences in the relationships between of divine control scores and self-reported attitudes and behaviours may arise not from nationality (or national culture), but from religiosity. In Kenya and Bangladesh, a belief in divine control largely served a protective function, while in the other countries it was generally associated with riskier attitudes and behaviours. In Kenya, the large majority of the sample (94%) reported following Christianity, while in Bangladesh, 90% reported following Islam. These are related, insofar as both are

1 Abrahamic, monotheistic religions. In the remaining countries non-theism, expressed as

2 Buddhism in Thailand (at 93% of the sample), and as atheism in China (at 87% of the

3 sample), Vietnam (at 66%), and the UK (at 58%), was the prevailing theology. Something

4 Islam and Christianity have in common, which separates them from Buddhism (which is also

5 influential in China and Vietnam, despite the majority reporting no religion) and atheism, is

6 the belief in a single God that has provided divine values by which a person should live. In

7 contrast, the concept of karma is central to Buddhism, whereby an individuals' intents and

8 actions influence that individual's future. It is possible that these differences (e.g., in the way

9 the question of obedience to rules or norms is approached) may be at the base of the

10 differences in relationships found here.

11 It would also be interesting to look into the presence of a state religion (as is the case in

12 Bangladesh, and in Iran where it also served a protective function; Nabipour et al. 2015), and,

13 relatedly, the political ideology in place in a given country, in order to explore more deeply

14 the relationships discussed here. That said, religion and political ideology are closely linked

15 with culture and national identity. To tease these influences apart would require research that

16 goes beyond that which we have described above, hence representing a valuable avenue for

17 future work. Such work could include a focus on the effect of religious orientation on a belief

18 in divine control and road safety attitudes and behaviours, and on the relationships therein.

19 Such research would do well to expand into additional countries with different interpretations

20 of the religions under study, for example in different African expressions of Islam (e.g.,

21 Gambia, Senegal, Somalia, etc.) and Latin American interpretations of Christianity (e.g., in

22 Mexico, Paraguay, Colombia, etc.), to include different religions (e.g., Judaism, Hinduism),

23 and to explore the aforementioned relationships within a single country where multiple

24 religions are present in relatively large proportions (e.g., France, Mauritius, Singapore, etc.).

25 Such research would likely shed light on the root of the differences found in our results.

26 Regarding the internality scale, differences between the country sample were again

27 seen. In China, Thailand, and Vietnam, a lower belief in the influence of one's own actions

28 was directly associated with the self-reported performance of riskier pedestrian behaviours of

29 all three categories assessed. These relationships were not found in the Kenya, or UK

30 samples (though note the low internal reliability in the Kenya sample for the internality

31 factor), and in Bangladesh internality was linked only with the self-reported performance of

32 aggressive pedestrian behaviours, not lapses or violation. A number of researchers have

33 shown internality and locus of control to be related to culture (e.g., Mueller & Thomas, 2001;

34 Shirazi & Biel, 2005). As such, one possible explanation of our result is that there is

something that the Chinese, Thai, and Vietnamese cultures share that distinguishes them, in a consistent way, from Bangladesh, Kenya, and the UK; for example, a belief in Buddha. This would certainly need targeted, cross-cultural research to clarify. That said, an additional question arises when considering our finding that the effect of internality on behaviour is direct, with little mediation through attitudes. Even where direct links were seen between the internality and attitudes factors, effect sizes were small (at .14 and .12 in China and Vietnam, respectively). This contrasts with findings reported in previous research (Nordfjærn & Şimşekoğlu, 2013). Such a result can perhaps be explained by the factor's direct similarity to the concept of perceived behavioural control (Ajzen, 2001; Ajzen & Fishbein, 1980), or self-efficacy (Bandura, 1977). In Ajzen's (1985) theory of planned behaviour model, perceived behavioural control is directly linked with behaviour (and intentions to perform behaviour), a relationship not said to be mediated through attitudes. Nevertheless, this does not explain the lack of relationship found in Bangladesh, Kenya, and the UK.

Taking the results together, it can be seen that in the Kenya sample relationships between factors were weaker than in any other country; the only effect that reached even a small-to-medium size was that of general fatalistic beliefs on road safety attitudes. Moreover, although a detailed treatment of the relationship is outside the scope of the current paper, it is worth pointing out that we also found attitudes to predict behaviour to a lesser extent in Kenya than in any other country. This result is consistent with existing research showing attitudes to predict driver behaviour to a lesser extent in Sub-Saharan Africa than in other world regions (Lund & Rundmo, 2009; Nordfjærn et al. 2011; 2014). Results from those studies, taken together our own results, suggest that the route to a safer road system in Sub-Saharan Africa is unlikely to be through the targeting of road safety attitudes, at least in terms of the types of attitudes assessed in our work and in that of Lund, Rundmo, Nordfjærn, and colleagues. Our results suggest that beliefs (of the sort assessed here) would also be a poor target for such road safety campaigns, as relationships in that regard were also weak (though results should be interpreted with a greater degree of caution given low internal reliability for the internality and luck scales in the Kenya sample, at $\alpha = .61$ and .69, respectively). As such, we tentatively posit that interventions other than those aimed at changing underlying attitudes and beliefs, for example procedural training and infrastructural change, would represent a more suitable focus of attention for road safety practitioners in those settings. That said, we must accept the possibility that the types of beliefs and attitudes assessed here (or in previous road safety research; Lund & Rundmo, 2009; Nordfjærn et al. 2011; 2014) are not those that best explain risky on-road behaviours in Kenya, or other Sub-Saharan settings. To address

this point would require a broader exploration of attitudes (i.e., looking into more than those investigated here or previously) and their relationships with behaviours, be that self-reported or directly observed.

Looking at the overall picture of results, although most effect sizes were small, many effects (total, direct, or indirect) were significant at the $p < .001$ level. Given the differences revealed by the analyses, we would therefore would argue that there is evidence to suggest that the relationships between the various constructs investigated (i.e., fatalistic beliefs, road safety attitudes, and pedestrian behaviours) differ across countries. This is in support of some existing research; for example, Şimşekoğlu et al. (2013) showed that Turkish road users held less fatalistic beliefs and reported safer driving behaviours than their Iranian counterparts, while Nordfjærn et al. (2012) found that fatalistic beliefs strongly predicted risky driving behaviour in Turkey, but not in Norway. Our results go further, however, suggesting that different aspects of fatalism are more influential in some contexts compared to others, and that for religious beliefs, relationships can be in opposing directions. Care should therefore be taken when considering the aspect of fatalism under analysis when conducting studies of traffic safety and beliefs.

Nevertheless, where relationships between concepts existed, they were generally in the direction hypothesised; those with stronger fatalistic beliefs and more external orientations reported having riskier attitudes to road safety and reported performing riskier pedestrian behaviours (the notable exception being the effect of religious beliefs in Bangladesh and Kenya). Given the effect of driver coaching on locus of control attributions (Stanton et al. 2007), and the link between locus of control and traffic accidents (e.g., Özkan & Lajunen, 2005), this has strong implications for traffic safety education and training. Importantly, however, the focus on education and training efforts should not be uniform across countries, but tailored to the context of application.

If we can affect the way people interpret causation and responsibility, we may be able to affect traffic safety outcomes. Although the human factors and safety science literature has, across domains, been moving away from blaming the end user and instead looking to systemic factors to explain (and design out) failure (e.g., Larsson et al. 2010; Hollnagel, 2018), it is important not to lose sight of the fact that responsibility for road safety is shared across all actors in the system (McIlroy et al. 2019), *including* the end users.

7. Limitations and future work

The most significant limitation to the current study is in the sample. Although it was relatively large (in comparison to much of the research referenced in the introduction), given the sampling methods used it cannot be said to be representative of the wider populations in each country. Although we used sampling methods similar to those reported by Şimşekoğlu et al. (2012), Nordfjærn et al. (2012), Deb et al. (2017), Granié et al. (2013), Ngueutsa & Kouabenan, (2017), there were differences in the sampling methods used in each country. This reflected different requirements for working in those settings, and differences in resources and expertise. Partly as a result of this, the samples differed in their weightings towards given groups. For example, the Bangladesh sample was predominately male, whereas the Thailand sample was weighted towards females. Across all countries, we attracted more younger individuals than is representative of the wider population. Although we controlled for age and gender in our analyses (in a manner consistent with the contemporary literature; e.g., Hart, 2018), we cannot be certain that these differences did not affect our results. We also did not include personal income or education level in our analyses; there is some research that these affect self-reported traffic safety behaviours (e.g., Shinar et al. 2001), and it is likely that both factors differed across the country samples (though the extent to which they are comparable is far from certain). To include these in future research of this kind would likely shed further light on the determinants of road user behaviour.

Additionally, we saw significant cross-country differences in the mode of transport most commonly used by respondents, and the amount of time they spent using the road system. Although we were able to control for the latter (by including exposure to the road system in the models), we did not include a control for road user group in our analyses (note also that we did not have a dedicated measure of walking frequency; this would be valuable in future research, and represents a limitation to the study). One of the main reasons for using a measure of pedestrian behaviour is that (almost) all road user groups are able to interact with the road system as a pedestrian, and commonly do so. Using a measure of this type of behaviour is therefore far more inclusive than a measure of, for example, driver behaviour or rider behaviour; these measures can only capture subsections of a population, excluding those who do not have access to a car or a motorbike. This is particularly important in low- and middle-income settings, where motorisation rates are lower, and the most commonly used means of transport are different to those seen in North America or Europe, where the very large majority of traffic safety research is undertaken (but where, arguably, it is least needed). The road systems in the countries investigated here differ greatly in terms of the most

commonly used transport modes, with public transport and walking making up greater shares in Bangladesh and Kenya, the private car presenting the most common mode in the UK, and the motorbike being ubiquitous in Vietnam. Although individual group analyses would be interesting (e.g., those looking into differences between motorcyclists of different cultural backgrounds), the purpose of the current study was to look at road users in general.

The tendency to behave in a risky manner as a driver is strongly related to the tendency to do so as a pedestrian (e.g., Şimşekoğlu, 2015); although we know of no research to confirm the link, we would expect the same to be true for motorcyclists, bus passengers, rickshaw driver, etc. A person's willingness to behave in a risky manner might be related to transport mode choice, but it does not arise from it; it is a more fundamental aspect of personality (e.g., Nicholson et al. 2005). We posit, therefore, that our results provide a valid and useful view of the relationships between traffic safety behaviours, attitudes, and fatalistic beliefs, across road users of different cultural settings. That said, we must still accept country differences as a limitation, particularly with regards to the over-representation of car drivers in Thailand and Kenya). The results are, therefore, useful, but they should be taken as a starting point rather than a definitive answer to the effects of fatalistic beliefs in the context of traffic safety. Although we found clear evidence for the existence of different models in each country, we suggest that these be tested, with more representative and (ideally) larger samples individually.

As with all self-report questionnaire studies, we must also accept the potential for biases in responding. There have been suggestions that such biases may differ across cultures (e.g., Johnson et al. 2005); this would have the potential to affect the extent to which we could draw conclusions from our results. Although direct observations of on-road behaviours would address this challenge for the pedestrian behaviour scale, direct observations of attitudes and beliefs are not possible, rather they would have to be inferred form observations of other behaviours. This approach would, of course, bring about its own challenges and limitations, especially in low- and middle-income settings.

Although we looked at road safety attitudes, they were not specifically concerned with pedestrian behaviours, rather were generic attitudes to traffic safety across road users and situations. It is likely, therefore, that the relationships between self-reported behaviours and attitudes would be stronger if the attitudes elicited concerned the very behaviours also questioned (see, e.g., Nordfjærn & Zavareh, 2016). Future research would do well to investigate this more closely.

Finally, it would be interesting to investigate a wider variety of countries, including more high-income countries, and countries in the Americas, a region not included in our research. This would be help build a better understanding of regional similarities and differences, and shed light on the differing effects of national income, development, and cultural factors on traffic safety and pedestrian behaviour.

8. Conclusions

This research has given an initial indication that a person's fatalistic and attributional tendencies have significant effects on their self-reported tendency to perform memory and attention errors, rule violations, and aggressive behaviours as a pedestrian, and on their attitudes to road safety. Results from the survey of 3,423 respondents showed there to be significant differences in the relationships between the various concepts across the six countries included in the investigation. Although some similarities were found (suggesting a possible focus for road safety training and education across nations), the differences suggest tailoring to the national and cultural context will be needed for interventions to be most effective. Although differences in sampling methods across countries mean that this should be considered as a preliminary study, rather than a definitive indication of cultural differences, results adds to the growing body of literature on the effect of different culturally-relevant factors in traffic safety, a literature that still commonly focusses on the car driver. Moreover, it represents a valuable addition to the literature on traffic safety in low- and middle-income countries, settings that are still under-represented given global road fatality and casualty statistics.

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