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1 Theory of Planned Behaviour, Psychological Stressors and Intention to Avoid Violating
2 Traffic Rules: A Multi-Level Modelling Analysis

3

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26 **ABSTRACT**

27 This study applies a multilevel model approach to test the predictive effect of the theory of
28 planned behaviour (TPB) plus moral norm, past behaviour and crash history to account for
29 intentions to avoid traffic violations within the context of commuting to or from work. This
30 study also extended the theory by adding psychological stressors of perceived stress and
31 work-family conflict. In this study, we systematically tested the direct and mediated models.
32 A sample of Malaysian drivers (N = 482; 44.6% were men and 55.4% women), with the
33 average age of 36.7 years (SD =10.0) was surveyed. The self-report questionnaire contained
34 multiple observations nested within individual drivers, with respect to 3 different driving
35 violations. As predicted, multi-level modelling showed that within-person predictor variables
36 of all the TPB components emerged as independent predictors, with injunctive norm being
37 the most predictive variable, followed by self-efficacy and cognitive attitude. Intention was
38 also predicted by moral norms and crash history. Between-person variables, gender,
39 commuting hours and work-family conflict also had direct influences on intention (i.e., men
40 and those with longer commuting hours and higher work-family conflict reported lower
41 intentions). Substantial support for the mediation model was found, confirming that stressors
42 indirectly influence intentions through the effects of the socio-cognitive components. The
43 implications of the linkage between the social cognition and stressors for developing potential
44 broader interventions focusing on multiple violation behaviours and designing appropriate
45 safety policies to reduce commuting crashes are discussed.

46

47 **Keywords;** The Theory of Planned Behaviour, traffic violations, work-family conflict,
48 perceived stress, commuting, multi-level analysis

49

50 **1. Introduction**

51 According to WHO (2018), the global rate of traffic death continues to rise steadily,
52 accounting for 1.35 million deaths each year, while between 20 and 50 million people suffer
53 nonfatal injuries and disabilities. Statistics show that low- and middle-income countries
54 (LMICs) have the highest proportions of road crash fatalities (Gupta & Bandyopadhyay,
55 2020). Statistics indicate that road traffic deaths globally are approximately 18 per 100, 000
56 population, with LMICs severely affected, contributing a high burden to 90% of the world's
57 road traffic deaths (Staton et al., 2016). While much attention has been focused on traffic
58 safety and violations in developed countries (Bhalla et al., 2020), little attention has been paid
59 to LMICs, despite these alarming figures. Furthermore, in recent years, the frequency of
60 commuting crashes that take place on the way to and from the place of work (International
61 Labour Organization, 2010) has become a serious issue in many parts of the world (Bin,
62 2014; Turgeman-Lupo & Biron, & 2017; Vargas-Garrido et al., 2021) and is a source of
63 much concern especially in LMICs (Bin, 2014). Unlike developed or high-income countries,
64 many LMICs have made little progress in addressing this issue (Ning et al., 2016).

65 The present study was conducted in Malaysia, one of the LMICs with
66 disproportionately high risk and burden of road traffic crashes, in which the crash death rate
67 is the third highest in Asia (WHO, 2018). A report from the Ministry of Transport of
68 Malaysia (2021) highlights the fact that the number of road crashes in Malaysia has increased
69 gradually during the last ten years from 414,421 in 2010 to 567,516 in 2019, killing 6,000 to
70 7,000 yearly. The burden is expected to escalate because of rapid urbanisation and
71 motorisation (Musa et al., 2020). Importantly, the rising trend of the occurrence of
72 commuting related crashes that contribute to the data is posing an enormous challenge (Bin,
73 2014; Sukor et al., 2018; Zuwairy et al., 2020). For instance, a report by the Social Security

74 Organization suggests that the trend for commuting crashes increased each year, from 28,037
75 cases in 2014 to 35,243 in 2018 (SOCSCO, 2018).

76 There is ample evidence that traffic violations, defined as deliberate contraventions of
77 safe driving practice (Parker et al., 1995), are a main contributory factor to traffic crashes
78 (Zhang et al., 2019). In light of the existing data, it seems prudent to understand factors
79 underpinning motives behind traffic violations during commuting. Within the traffic safety
80 field, several studies have found the overspill of stress from other sources into the driving
81 environment (Bowen et al., 2020; Rowden et al., 2011), suggesting that the potential link
82 between stressors and traffic violation is a challenging research issue. Yet, the possible
83 mechanisms explaining stress-violation relationships have not fully explored (Westerman &
84 Haigney, 2000). This is noteworthy, considering the need for theory-based studies in order to
85 guide appropriate intervention, this study thus integrates the contribution of a stress
86 perspective on the theory of planned behaviour (TPB) in understanding traffic violations.
87 Specifically, we investigate the influence of psychological stressors, with particular attention
88 to work-family conflict, perceived stress, and additional variables in relation to intentions to
89 avoid traffic violations, guided by the framework of TPB within the context of commuting in
90 isolation from other driving behaviours.

91 *1.1 Theory of planned behaviour and traffic violation*

92 Reviews and analyses have noted the TPB (Ajzen, 1991) as an influential model for
93 understanding social behaviour (Ajzen, 2011; Armitage & Conner, 2001; Conner & Norman,
94 2015; McEachan et al., 2011). Such findings have sparked vigorous investigation into the
95 efficacy of the model within the context of various health behaviours. An underlying
96 assumption of the TPB is that behavioural intention is a key determinant of behaviour.
97 Behavioural intention reflects an individual's motivation to perform a particular behaviour
98 based on his/her efforts and planning. In the TPB, behavioural intention is a function of three

99 independent determinants: attitudes, subjective norms, and perceived behavioural control
100 (PBC). Attitude refers to a favourable or unfavourable evaluation of the behaviour (Ajzen,
101 1991), which conceptually comprises cognitive (the extent to which the behaviour is
102 perceived as beneficial) and affective (the extent to which the behaviour is perceived as
103 pleasant) components (Lawton et al., 2009). The second determinant of intention is subjective
104 norm, which is defined as an individual's perception of whether important people would
105 approve or disapprove of the behaviour. Researchers (Cialdini et al., 1991; Conner et al.,
106 2007) have further distinguished between injunctive (i.e. perceptions of others' approval of
107 the behaviour in question) and descriptive norms (i.e. perceptions of whether others are doing
108 the behaviour in question). PBC is the third independent determinant of intention,
109 conceptualised as the perceived ease or difficulty of performing the behaviour (Ajzen &
110 Madden, 1986). Many studies have reported the multidimensional nature of PBC constructs
111 (Trafimow et al., 2002). Despite this research, the dimensionality of PBC remains
112 controversial. Among the two distinct yet interrelated components often included in TPB
113 studies are perceived difficulty (i.e. perception of the ease or difficulty of performing the
114 behaviour in question) and self-efficacy (i.e. perception of how confident the actor is that he
115 or she can perform the behaviour in question). Empirical studies have reported the relative
116 importance of these three components, which vary depending on the behaviour in question
117 (Armitage & Conner, 2001; McEachan et al., 2011). In addition, a number of TPB studies
118 (Hagger et al., 2007; Hassan et al., 2016; Shukri et al., 2016) have proposed specific
119 hypotheses for the impact of TPB components across cultures and populations, hence there
120 should be the possibility of cross-cultural variation in the influence of the TPB components in
121 this Malaysian sample as opposed to previous samples.

122 The TPB has been used to predict traffic violations (Elliot & Thomson, 2010;
123 Lheureux et al., 2016) and intention to commit violations (Atombo et al., 2016; Forward,

124 2006, 2009; Parker et al., 1992; Rowe et al., 2016). In general, the findings for the TPB
125 varied across samples and road violations, explaining 33% (dangerous overtaking; Forward,
126 2009) and 45% to 69% (speeding; Conner et al., 2003; Rowe et al., 2016, respectively) of the
127 variance in intentions.

128 *1.2 Roles of additional predictor variables*

129 Researchers have proposed the use of moral norms to explain traffic behaviours (Chorlton et
130 al., 2012; Parker et al., 1995), usually as an additional form of normative pressure (Conner &
131 Armitage, 1998). Moral norms can be defined as feelings of personal responsibility and moral
132 obligation to perform or not perform a behaviour (Ajzen, 1991). In general, traffic violations
133 are thought to be unacceptable with regard to generally accepted norms (i.e. immoral
134 actions), partly because such behaviour can provoke harm by creating road hazards and
135 endangering drivers or other road users. A few studies (Conner et al., 2003; Conner et al.,
136 2007; Elliot et al., 2010; Parker et al., 1995; Shevlin & Goodwin, 2019) have demonstrated
137 the predictive effect of moral norms on various driving behaviours, reflecting the fact that
138 perceived moral obligation seems to be important with regard to intention formation to avoid
139 traffic violations.

140 The construct of past behaviour has been commonly added to the TPB and been found
141 to contribute to the prediction of intention and future behaviour, explaining variance beyond
142 the original TPB variables across different behaviours (Ajzen, 1991; Conner & Armitage,
143 1998; McEachan et al., 2011; Ouellette & Wood, 1998). Some studies on traffic safety have
144 found that the addition of past behaviour has led to statistically significant increments in
145 explaining variance in intentions (Conner et al., 2003, 2007; Forward, 2009; Shevlin &
146 Goodwin, 2019; Vankov et al., 2021). Regardless of supporting evidence, the discussion of
147 the vague conceptualisation of past behaviours continues (Jovanović et al., 2017). However,
148 in the present study, we operationalized past behaviours as violation behaviours on the road

149 in response to external or internal stimuli committed in the past (Ajzen, 1991). The role of
150 past behaviour in the TPB has been ascribed to the notion that frequent (violation) behaviours
151 in the past may inspire subsequent violation acts by providing drivers with experience of the
152 behaviour and through the formation of habitual processes (Ouellette & Wood, 1998).

153 In addition, crash history was included in the model to provide insight into the
154 association between past involvement in crashes and intention. The link between crash
155 history and traffic behaviour has been investigated in several studies. While it is assumed that
156 drivers who have been involved in a crash would subsequently intend to behave more safely
157 on the road (Ngueutsa & Kouabenan, 2017), the results of these studies do not always support
158 this idea. For instance, Simon and Corbett (1996) found that past crashes were related to
159 increased traffic violations. Another study (Ngueutsa & Kouabenan, 2017) found that drivers
160 who reported involvement in more than three crashes or in a severe crashes were reported to
161 be less safe than those involved in fewer or less severe crashes. However, Weinstein (1989)
162 found no relationship between personal crash and injury experience with subsequent safety
163 behaviour (i.e. seat belt use).

164 *1.3 Psychological stressors and traffic violation*

165 Increasing evidence supports the hypothesis that psychological stress undermines driving
166 safety (Legree et al., 2003). Stress within the field of traffic violation studies has been
167 broadly conceptualised to include properties specific to driving experience and personal
168 factors originating from interpersonal and job problems (Roidl et al., 2014; Rowden et al.,
169 2011). For instance, a previous study (Westerman & Haigney, 2000) found that high levels of
170 driver stress (i.e. specific to the driving situation) were associated with increased lapses,
171 errors, and traffic violations among professional drivers. Another study has indicated that
172 stressors derived from domains outside of driving experience appear to predispose drivers to

173 a number of negative driving outcomes (Rowden et al., 2011). Ge et al. (2014) found that the
174 global perception of stress derived from ongoing life circumstances and expectations
175 concerning future events contributed to the risk of dangerous driving behaviour.

176 In addition to considering a global assessment of stress, investigators have explored
177 the possible varying effects of specific types of stressors (Bowen et al. 2020; Rowden et al.,
178 2011). Many studies have demonstrated that work-related stress has a negative impact on
179 driving behaviours (Havârneanu & Havârneanu, 2012; McLinton & Dollard, 2010).
180 Meanwhile, ample evidence supports the detrimental effect of work-family conflict on
181 various work, non-work, and health-related outcomes (Amstad et al., 2011). Work-family
182 conflict is an inter-role stress that results from incompatible demands from work and family
183 domains (Greenhaus & Beutell, 1985). According to the conservation of resources theory
184 (Holmgreen et al., 2017), such inter-role conflict leads to stress because personal resources
185 (e.g. time and energy) are lost in the process of juggling both work and family roles, leading
186 to a negative state of being leading to petulance, fatigue, physiological tension, and negative
187 emotions. Despite the fact that interest in the work-family domain is not new, the potential
188 impact of work-family conflict on road safety has been largely ignored. However, Turgeman-
189 Lupo and Biron (2017) demonstrated that work-family conflict leads to increased unsafe
190 commuting behaviours, and Shukri et al. (2021) extended this framework to study dangerous
191 driving acts, finding that work-family conflict predicts dangerous driving behaviours via the
192 role of negative affect.

193 Although evidence suggests that stress has the potential to impair road safety, the
194 nature of the association between violations and stress is less clear (Westerman & Haigney,
195 2000). There is a need to empirically examine this issue to provide a more elaborate
196 understanding of the mechanisms underlying the detrimental effect of stress within the traffic
197 violation context. We posit that stressors may influence intention formation in two ways.

198 First, stressors are expected to directly influence intention formation. This is based on the
199 assumption that people's behavioural intentions are formed from their beliefs about
200 performing (violation) behaviour (Ajzen & Fishbein, 2005) and that external factors,
201 including stressors, can potentially influence such beliefs. Stressors have been discussed in
202 terms of their detrimental effects on cognitive functioning, such as inhibiting appropriate
203 decision-making, directing attention, and impeding goal-directed choices by reducing self-
204 control (Maier et al., 2015). While there are various lines of evidence demonstrating that
205 stress can precipitate a variety of maladaptive outcomes at the behavioural level as reviewed
206 above, most of which are indicative of poor self-control and self-regulation failure
207 (Baumeister & Heatherton, 1996), it is also possible that stress is a potent threat to self-
208 regulation that operates at the goal and intentional stage (Wagner & Heatherton, 2013). Thus,
209 based on the depletion of self-regulatory resources (Baumeister, 1997), one could expect that
210 stressed drivers who became emotional because of uncontrollable personal demands were
211 less inclined to avoid rule violation compared to less stressed drivers because of the notion
212 that stress lowered the perception of self-control at the motivational level. In addition, a few
213 investigators (Louis et al., 2009; Pak et al., 1999) have noted that aversive stress is linked to a
214 broad range of (negative) outcomes based on basic hedonistic principles, the idea that human
215 motivation is a function of the pursuit of pleasure and the avoidance of displeasure (Williams,
216 2018). At the motivational level, it is anticipated that people will be motivated to engage in
217 law-breaking on the road to the extent that it is hedonically rewarding (Lawton et al., 1997;
218 Rowe et al., 2016) and provides relief from the displeasure of stress. Conversely, stressed
219 people are often less motivated to engage in safety behaviours, partly because such
220 behaviours reduce pleasure.

221 Second, in line with the TPB framework (Ajzen & Fishbein, 2005), we postulate that
222 stressors may influence the formation of intentions through the influence of behaviour-

223 specific cognitions. In attempting to explain the role of stress in the TPB, Louis et al. (2009)
224 proposed that the hedonic nature of stress has the ability to alter people's attitude towards a
225 particular behaviour, disrupt social and normative influences, and weaken self-efficacy and
226 self-regulation. This suggests that psychological stress may directly shape the three
227 antecedents of intentions: attitude, norms, and PBC. However, few health behaviour studies
228 have tested the role of TPB components as stress mediators, though these found some support
229 for the mediation hypothesis. For example, Budden and Sagarin (2007) reported the
230 mediating role of PBC in the relationship between job stress and intention to exercise. In
231 another study, Shukri et al. (2016) found that specific stressors (i.e. job demands) can have
232 important indirect effects on healthy eating intention via its effect on attitudes and PBC.
233 While several lines of research in health decision-making have included stress variables
234 within the TPB framework (Budden & Sagarin; Louis et al., 2009; Payne et al., 2005; Shukri
235 et al., 2016), this study is among the first to integrate the contribution of a stress perspective
236 with the TPB approach in the transport safety field.

237 In our reading of the TPB literature, there have been limited studies on the mediating
238 role of moral norms with respect to the relationship between predictors (i.e. stress) and
239 intentions. While moral norms are expected to have an important influence on the drivers'
240 choice to obey or transgress the rules (Holman & Popusoi, 2018), findings suggest that stress
241 appears to directly affect moral reasoning (Starcke et al., 2011; Youssef et al., 2012). For
242 example, in a series of experimental studies, Shalvi et al. (2012) found that individuals under
243 stressful conditions (i.e. time pressure) were more likely to engage in unethical decision-
244 making, such as cheating.

245 *1.4. The current study:*

246 This study extends existing research in two distinct ways. While previous work
247 highlights important conclusions regarding the power of the TPB components to predict
248 violations on the road, such studies may imply that intervention programs should target a
249 selected single violation behaviour. However, there are also proposals for promising
250 interventions that may be cost effective and efficient ways to broadly address multiple
251 behaviours (Jackson et al., 2012). Thus, it is necessary to examine the key predictors of
252 multiple violation behaviours simultaneously. To serve this purpose, the current study
253 employed a multilevel approach in which a comprehensive design and analytic framework
254 was used to account for variance in intentions across three violation behaviours (Steenbergen
255 & Jones, 2002). By considering the simultaneous influence of the predictors at different
256 levels; three related violation (i.e. driving above the speed limit, illegal overtaking, running
257 red light) variables (level-1) clustered within individuals (level-2) on the outcome variable,
258 this study avoids the methodological problems in applying traditional techniques (Conner et
259 al., 2016). In particular, the multi-level modelling with random effects makes it possible to
260 deal with the issue of dependence of observations, estimating correct standard error and thus
261 providing a more appropriate significance test (Raudenbush & Bryk, 2002; Vanlaar 2005).
262 The advantages of multilevel modelling analyses were convincingly illustrated in previous
263 TPB studies (Conner et al., 2016; Conner et al., 2017; Sandberg et al. , 2016; Schüz et al.,
264 2020). Hence, the study adds to the relevant literature by expanding previous TPB studies
265 utilising multilevel modelling analyses (Conner et al., 2016; Conner et al., 2017; Schüz et al.,
266 2020) to include psychological stressors to account for variance in intentions. Secondly,
267 previous meta-analyses of the TPB (Conner et al., 2017; McEachan et al., 2011) suggested
268 differences in the predictive power of the TPB for risk and protective behaviours. Since there
269 is an extensive body of TPB literature on traffic violations, viewed within risky behaviour
270 (i.e. motives behind speeding and other violations), which can be hedonistic in nature

271 (Lawton et al., 2009), it is of particular interest to extend the literature to understand a
272 preventive behaviour framework (i.e. motives to not commit traffic violation during
273 commuting).

274 The first aim of the current study was to explore the influence of TPB variables on
275 intentions to avoid traffic violations. In light of the previous literature, we expected that the
276 components of attitude, subjective norms, and PBC will account for significant variation in
277 intentions (H_1). Second, in addition to the TPB variables, we examined the direct contributing
278 role of moral norms, past behaviours, and traffic crash history in the prediction of intentions.
279 In accordance with the literature, it was hypothesised that the proposed additional variables
280 will account for a significant increase in explained variance in intentions (H_2). Next, we
281 simultaneously investigated both the effect of the general perception of stress and the specific
282 nature of stressors (i.e. work-family conflict) on intention. This may help identify the
283 distinctive effect of each stressor, and thus tailor specific behavioural measures. It is expected
284 that perceived stress (H_3), work-family conflict (H_4), and intention are negatively related.
285 Specifically, as the stress increases, the intention to avoid violating rules decreases. Finally,
286 we aim to test the mediating effects of TPB components on stress-intention relations within
287 the context of traffic violation and further extend previous studies by examining whether any
288 influence of stressors on intention formation is transferred by the effect of moral norms.
289 Based on previous research, it was hypothesised that attitude, social norms, PBC of the TPB
290 components (H_5), and moral norms (H_6) mediate the relationship between stressors and
291 intentions.

292 **2. Method**

293 *2.1 Sample and procedure*

294 The protocol for the research for this study was approved by the Ethics Committee of
295 Universiti Malaysia Terengganu (UMT/JKEPM/2020/44). The participants were recruited

296 through a convenience sampling procedure from three large cities in Malaysia. This sample
297 consists of employees working full-time in a wide range of services, including education
298 (49.1%), banking (20.9%), telecommunication (11.5%), and government offices (18.5%),
299 identified via the human resources departments of the respective organisations. The inclusion
300 criteria were as follows: having had a driver's license and driving regularly to and from work.
301 Initially, 511 sets of data were collected. However, for this study, data from 482 participants
302 (94.3%) were analysed because of missing data. There were 215 (44.6%) men and 267
303 (55.4%) women. The majority of respondents were married and had children (75.5%). The
304 average age was 36.7 years (SD = 10.0 years), ranging from 18 to 60 years, who, on average,
305 possessed a full license for 15.43 years (SD = 9.04 years). Half of the participants reported
306 driving in less than 30 min to work (53.3%), 33.6 % took within 1 h to commute to work, and
307 13.1% took more than 1 h. For further detail see Table 1.

308

309

Insert Table 1 about here

310

311 *2.2 Measures*

312 Appendix displays the measurement items used in this study.

313 *2.2.1 Demographic information*

314 Basic demographic information including age (in years), gender, marital status, driving
315 experience (in years), and commuting hours were compiled for each participant.

316 2.2.2 Components of the TPB

317 In this study, we focused on intention to avoid committing three violation acts¹: driving
318 above the speed limit, illegal overtaking, and running red lights, all related to driving to work
319 (and back home). Definitions for driving above the speed limit, illegal overtaking, and
320 running red lights were provided to the participants. For this study, driving above the speed
321 limit was defined as driving in excess of the national speed limits². Illegal overtaking denotes
322 overtaking another vehicle from the left side, overtaking at a double line and overtaking on
323 narrow roads, a bridge and at places where overtaking is prohibited. Running red light, by
324 definition, refers as any vehicle entering the intersection (i.e. crossing the stop line) after
325 onset of red signal. The items used to measure the TPB components were similar across the
326 three types of traffic violations. Overall, the basic components of the TPB were measured
327 using standard questions from the literature (Conner & Norman, 2015). All TPB components,
328 moral norms, and past behaviour items, except history of traffic crashes, were measured on 7-
329 point response scales.

330 2.2.3 Intention

331 Intention was assessed using two items for each of the relevant violations. For example, 'I
332 intend to refrain from driving above the posted speed limit, while driving to and from work
333 over the next two weeks' (*strongly disagree–strongly agree*). Cronbach's α for the scales
334 ranged from 0.74 to 0.79 across the three behaviours.

335 2.2.4 Attitudes

¹ The traffic offenses included in this study are subjected to the Malaysian Road Safety Act 1987.

² The participants were given information related to Malaysian default speed limits (highways: 110 km/h (68 mph); federal roads: 90 km/h (56 mph); state roads: 90 km/h (56 mph); town: 60 km/h (37 mph); school areas: 35 km/h (22 mph).

336 Attitudes were measured using four items, for example, ‘For me, to refrain from driving
337 above the posted speed limit while driving to and from work would be...’, followed by
338 endpoints (*foolish–wise; harmful–beneficial*) for cognitive attitude and endpoints (*not*
339 *enjoyable–enjoyable; unpleasant–pleasant*) for affective attitude. Cronbach’s α for the scales
340 ranged from 0.88 to 0.93 across the three behaviours.

341 2.2.5 Social norms

342 Injunctive norms were measured using two items, for example, ‘Most people who are
343 important to me think I should refrain from driving above the posted speed limit, while
344 driving to and from work’ (*strongly disagree–strongly agree*). Descriptive norms were
345 measured using two items consisting of the statement, for example, ‘I think most people who
346 are important to me refrain from driving above the posted speed limit, while driving to and
347 from work’ (*strongly disagree–strongly agree*). Cronbach’s α for the two scales ranged from
348 0.82 to 0.86 across the three behaviours.

349 2.2.6 PBC

350 Self-efficacy was measured using a single item, for example, (‘If it were entirely up to me, I
351 am confident that I could refrain from driving above the posted limit, while driving to and
352 from work’, *strongly disagree–strongly agree*). Two items made reference to perceived
353 difficulty, for example, ‘How difficult is it to refrain from driving above the stated speed
354 limit when you are really in a hurry, while driving to and from work?’ (*very easy–very*
355 *difficult*). Cronbach’s α for perceived difficulty ranged from 0.72 to 0.82 across the three
356 behaviours.

357 2.3 Additional predictors

358 2.3.1 Moral norms

359 Moral norms were measured using a single item, for example, ‘It will be quite wrong for me
360 to drive above the posted speed limit, while driving to and from work’ (*definitely no–*
361 *definitely yes*). The use of a single item was based upon previous studies (Conner et al., 2003;
362 Conner et al., 2007; Elliot & Thomson, 2010) using this construct to allow comparable
363 findings.

364 2.3.2 Past violation behaviours

365 Past behaviours were measured using two items, for example, ‘In the past, I frequently drove
366 above the posted speed limit, while driving to and from work’ (*strongly disagree–strongly*
367 *agree*). Cronbach’s α for the scales ranged from 0.77 to 0.78 across the three behaviours.

368 2.3.3 History of traffic crash

369 The participants completed single-item measures for past crash involvement across the three
370 behaviours, for example, ‘How many times were you involved in a traffic crash by driving
371 above the posted speed limit in the past two years’ (range *0–more than seven times*).

372 2.4 Psychological stressors

373 2.4.1 Perceived stress

374 The Perceived Stress Scale (PSS; Cohen et al. 1983) was used to measure the perception of
375 stress over the past month. An abbreviated version of the PSS was used, which contained 10
376 items using a 5-point scale, for example ‘How often have you been upset because of
377 something that happened unexpectedly’ (*never–very often*). The ten-item scale has been used
378 widely in various cultures and populations (Lee, 2012). It has been found that the measure
379 provides a psychometrically useful tool to measure perceived stress as compared to those of
380 the original instrument (Remor, 2006; Lee, 2012). Cronbach’s α for the scale was 0.75.

381 2.4.2 Work-family conflict

382 Work-family conflict³ was measured using scales based on Carlson et al. (2000), capturing
383 time and strain-based work-family conflict. Twelve items were used and scored on a 5-point
384 scale, for example ‘My work keeps me from my family activities more than I would like’
385 (*strongly disagree– strongly agree*). Higher scores indicated greater conflict. Cronbach’s α
386 for the scale was 0.91.

387 *2.5 Statistical analysis*

388 The data were analysed using SPSS for initial analysis (means, SDs, reliabilities, and
389 intercorrelations) and Hierarchical Linear Model 8 software (multilevel random coefficient
390 modelling; Raudenbush & Congdon, 2021) with the default setting of full maximum
391 likelihood.

392 Data sets from 482 participants were used, providing 1,446 within person-behaviours data. In
393 each multilevel model, every participant was therefore associated with a regression line that
394 included an intercept and slope. Thus, each participant provided data at two levels, with level
395 1 being the within-person variables, including TPB components, past behaviours, moral
396 norms, and crash history. Level 2, the between-persons model, included gender, age, marital
397 status, driving experience and commuting hours, work-family conflict, and perceived stress.
398 In the current study, all standardised coefficients were modelled as fixed effects (i.e. dropping
399 the random error term) because of convergence problems (Nezlek, 2001). Level 1 predictors
400 were centred around the grand mean. To check whether multilevel modelling is appropriate
401 and needed in our study, we used a full-unconditioned model to estimate the intraclass

³ In the initial stages, we have evaluated the bidirectional nature of work interference with family (WIF) and family interference with work (FIW) as recommended by most work-family research (e.g. Amstad et al., 2011). However, we detected multicollinearity problems that undermine the statistical significance of the model. Therefore, it was decided to use only a global measure of work-family conflict.

402 correlation coefficient (ICC)⁴ which measures the proportion of variance in the outcome
403 variable (i.e. intentions) that is due to between person variance and a chi-square statistic
404 (Garson, 2013). Next, the deviance value was used as the basis for model fit measures, with a
405 greater decrease in the deviance (-2LL), suggesting an (significant/insignificant)
406 improvement in model fit (Garson, 2013). To test the mediation hypotheses, we performed
407 multilevel mediation effects with the MLmed Macro in SPSS (Rockwood & Hayes, 2017).

408 **3. Results**

409 *3.1 Correlational analyses*

410 Table 2 shows that all TPB components are significantly correlated with intentions. The
411 directions of all TPB-intention relationships were positive, except for perceived difficulty,
412 which correlated negatively with intention because of the way the construct was
413 operationalised (easy–difficult). Moral norms and crash history (negative correlation) were
414 also significantly correlated with intentions. However, past behaviours were not related to
415 intentions. All level 2 variables were significantly correlated with intention, except for
416 marital status. As expected, both stressors were negatively correlated with intention, in that
417 higher stress was related to lower intentions. Older and more experienced drivers were
418 associated with a higher intention to avoid violations. Descriptive statistics showed that men
419 (mean = 4.90, SD = 1.96) and those with longer commuting hours (mean = 5.03, SD = 1.87)
420 reported lower intentions than women (mean = 5.37, SD = 1.86) and those with shorter hours
421 (mean = 5.27, SD = 1.94).

422

Insert Table 2 about here

424

425 *3.2 Predicting intentions*

⁴ Calculated as the intercept variance component in the null model divided by the total of variance components (Garson, 2013).

426 To test the main effects, intention was regressed on level 1 and level 2 variables. Model 1
427 included only demographic background as control variables; model 2 added stress variables
428 (work-family conflict, perceived stress); model 3 added TPB variables, past violation
429 behaviour, moral norms, and past crash history. While it is noted that past behaviour was not
430 significantly correlated bivariately with intention, the construct was included in the analyses
431 as a control variable, rather than as a component of the model (Terry & O'Leary, 1995). The
432 estimated ICC for the fully unconditional model was .55 and the Chi-square was also
433 significant ($\chi^2 = 2276.5$, $df = 481$, $p < .001$). Thus, 55% of the variance in intentions was
434 significantly explained by between-persons differences (i.e. Level 2 variables). These results
435 justify the use of a multilevel model to understand how intentions vary as a function of both
436 within-person and between-person variables.

437 As shown in Table 3, the results of the multilevel analysis showed that adding level 2
438 between-person demographic variables (Model 1) significantly reduced the deviance statistic
439 compared to the intercept-only model ($\Delta\chi^2 (5) = 24.28$, $p < .001$). At this step, gender and
440 commuting hours were significant predictors, indicating that women and those who commute
441 fewer hours reported a significantly higher intention to avoid violations. Adding stress
442 measures (Model 2) as a between-person predictor further significantly reduced the deviance
443 statistic ($\Delta\chi^2 (2) = 14.42$, $p < .001$). At this step, work-family conflict had a negative
444 significant effect, while perceived stress was insignificant, and gender remained significant.
445 Higher work-family conflict was found to significantly reduce intention to avoid violation,
446 confirming H_4 .

447 The inclusion of all TPB variables and additional predictors (Model 3) further
448 significantly reduced the deviance statistic ($\Delta\chi^2 (9) = 509.97$, $p < .001$). Confirming H_1 , all
449 components of the TPB were statistically associated with intentions, moral norms, and crash
450 history. Hence, H_2 is partially supported. Injunctive norms had the highest value, followed by

451 self-efficacy and cognitive attitude. Importantly, the impact of level 2 variables (demographic
452 background and stressors) was not significant at this step, indicating that their effect on
453 intention was fully mediated by TPB variables. However, consistent with the correlation
454 results, past violation behaviour was not significant.

456 Insert Table 3 about here

458 3.3 Mediation analyses

459 A multilevel mediation analysis was performed to further explore the mediating effect of
460 TPB on the stress-intention relationship. Considering the effect of perceived stress on
461 intention individually, significant mediated effects were found for cognitive attitude ($B = -$
462 $.0173$, $SE = .0070$, $z = -2.4660$, $p = .0137$, 95% CI $-.0315$, $-.0037$), descriptive norms ($B = -$
463 $.0098$, $SE = .0039$, $z = -2.5277$, $p = .0115$, 95% CI $-.0180$, $-.0027$), self-efficacy ($B = -.0268$,
464 $SE = .0073$, $z = -3.6525$, $p = .0003$, 95% CI $-.0418$, $-.0126$), and difficulty ($B = -.0115$, SE
465 $= .0038$ -3.0220 , $p = .0025$, 95% CI $-.0199$ $-.0048$) but not affective attitude ($B = -.0091$, $SE =$
466 $.0061$, $z = -1.4782$, $p = .1394$, 95 % CI $-.0215$, $.0029$), injunctive norms ($B = -.0265$, $SE =$
467 $.0095$, $z = -2.7928$, $p = .0052$, 95 % CI $-.0456$, $.0078$), and moral norms ($B = -.0113$, $SE =$
468 $.0072$, $z = -1.5636$, $p = .1179$, 95 % CI $-.0259$, $.0029$). In each case, the direct effect of
469 perceived stress was not significant, indicating a full mediation effect. When considering all
470 significant mediators simultaneously, the analysis showed that the direct effect of perceived
471 stress was not significant ($B = -.0005$, $SE = .0101$, $t = -.0509$, $p = .9594$, 95% CI $-.0204$,
472 $.0194$). There were parallel significant mediation effects for cognitive attitude ($B = -.0114$,
473 $SE = .0047$, $z = -2.4064$, $p = .0161$, 95% CI $-.0210$, $-.0025$), self-efficacy ($B = -.0188$, $SE =$
474 $.0053$, $z = -3.5230$, $p = .0004$, 95% CI $-.0298$, $-.0089$) and difficulty ($B = -.0043$, $SE = .0021$,
475 $z = -2.0121$, $p = .0442$, 95% CI $-.0090$, $-.0008$), suggesting a full mediation effect.

476 Furthermore, we conducted a similar multilevel mediation analysis to test the extent
477 to which the TPB variables and moral norms mediated the effects of work-family conflict on
478 violation intention. When the potential mediator was added individually, significant
479 mediation effects were found for cognitive attitude ($B = -.0141$, $SE = .0041$, $z = -3.4144$, $p =$
480 $.0006$, 95% CI $-.0226$, $-.0061$), affective attitude ($B = -.0093$, $SE = .0036$, $z = -2.5764$, $p =$
481 $.0100$, 95% CI $-.0167$, $-.0023$), injunctive norms ($B = -.0178$, $SE = .0056$, $z = -3.1864$, $p =$
482 $.0014$, CI 95% $-.0290$, $-.0067$), self-efficacy ($B = -.0177$, $SE = .0043$, $z = -4.0898$, $p = .0000$,
483 CI 95% $-.0265$, $-.0092$), difficulty ($B = -.0097$, $SE = .0026$, $z = -3.744$, $p = .0002$, CI $-.0153$, $-$
484 $.0051$), and moral norms ($B = -.0096$, $SE = .0042$, $z = -2.2581$, $p = .0239$, 95 % CI $-.0182$, $-$
485 $.0012$) but not for descriptive norms ($B = -.004$, $SE = .0022$, $z = -1.9503$, $p = .0511$, 95% $-$
486 $.0089$, $-.0002$). The direct effect of work-family conflict became non-significant in each case,
487 suggesting full mediation, except for cognitive attitude, difficulty, and moral norms, which
488 remained significant (partial mediation effect). When the significant mediators were entered
489 simultaneously, self-efficacy ($B = -.0071$, $SE = .0020$, $z = -3.5075$, $p = .0005$, 95% CI $-.0114$, $-$
490 $.0036$), difficulty ($B = -.0045$, $SE = .0015$, $z = -2.9077$, $p = .0036$, 95% CI $-.0078$, $-.0018$), and
491 injunctive norms ($B = -.0147$, $SE = .0046$, $z = -3.1606$, $p = .0016$, 95% CI $-.0240$, $-.0056$)
492 remained as significant mediators. The direct effect of work-family conflict became non-
493 significant ($B = -.0014$, $SE = .0052$, $t = -.2663$, $p = .7901$, 95% CI $-.0116$, $.0088$), indicating
494 full mediation effects. In summary, H_5 and H_6 are supported.

495 **4. Discussion**

496 Unlike the majority of tests of the TPB that focus on individual behaviours, the
497 current research examined effects across multiple behaviours. The former approach
498 focuses on between individual differences (i.e. does the individual with the strongest attitude
499 have the strongest intention). The latter approach focuses more on within-person differences
500 across behaviours (i.e. does the person most strongly intend to perform the behaviour for

501 which they have the strongest attitude). It could be argued that the latter approach is more
502 consistent with the TPB as a model of individual decision making about behaviour. In
503 addition, it is important to note that most existing studies have applied the TPB to predict
504 intentions to commit violations, and there is a scarcity of studies on the intention to avoid
505 violating rules. The results showed that both social norm components emerged as significant
506 predictors of intentions, with injunctive norms as the strongest. Such a result is not often
507 found in TPB studies. Specifically, reviews have reported comparative weakness of the
508 subjective norm-intention relationship in other domains (Armitage & Conner, 2001;
509 McEachan et al., 2011). Nonetheless, a number of studies (Hagger et al., 2007; Hassan et al.,
510 2016) have found variations in TPB variables drawn from Hofstede's (1980) collectivistic
511 versus individualistic cultural dimensions. Supporting these findings, a review of TPB studies
512 (Hassan et al., 2016) highlights differences in relationships between subjective norms and
513 intentions that vary across countries, in that such relationships were stronger in people in
514 collectivistic cultures than in individualistic cultures. In contrast, no systematic variation was
515 found for either attitude or PBC in their review. Overall, it may be that the relative salience of
516 the subjective norm components found in this Malaysian sample, who generally practise
517 collectivist lifestyles (Noordin, 2009), is dependent on such cultural sensitivity. The finding
518 that injunctive norm was a more powerful predictor of intention than descriptive norm is in
519 line with a meta-analysis by Manning (2009). Thus, the perception that most people
520 disapprove of violation behaviour is more important than the perception that others
521 commonly do not commit violations. As put forward by Parker et al. (1992), perceived
522 expectations of others could be a source of guidance in case of driving violations, partly
523 because driving behaviour is more or less a social performance, and one's action is likely to
524 have important implications for others.

525 In line with previous TPB studies (Atombo et al., 2017; Conner et al., 2007; Elliot &
526 Thomson, 2010; Rowe et al., 2016), the present findings confirmed attitude components as
527 significant predictors of intention. Previous studies on predicting intention to commit unsafe
528 driving (Atombo et al., 2017; Elliot & Thomson, 2010) have shown that affective measures
529 of attitude are more closely linked to intentions than to cognitive attitudes. These studies
530 support the role of feelings in predicting hedonic and impulsive violation behaviours, such as
531 speeding (Lawton et al., 2009). In contrast, we found that cognitive attitude was a stronger
532 predictor than affective attitude. This may add further support for the idea that, in the case of
533 preventive behaviour (avoiding violation), people are driven more by cognition than by affect
534 (McEachan et al., 2016).

535 This study also found that both PBC components were significant. That is, drivers
536 who reported a higher efficacy and lesser difficulty associated with the behaviour had
537 stronger intentions not to violate. Previous general road violation literature found a mixed
538 role for PBC on intentions. One explanation is the conceptual clarity of the PBC constructs
539 and behavioural relevance of control constructs (Rodgers et al., 2008). In this study, PBC
540 comprised items dealing with ease or difficulty and people's confidence in performing a
541 behaviour, which tapped the component of capacity (McEachan et al., 2016). Therefore, our
542 results were similar to those of studies that deal primarily with the component of capacity
543 (Cristea & Gheorghui, 2016; Elliott et al. 2005; Forward, 2006; Jovanović et al., 2017; Rowe
544 et al., 2016; Parker et al., 1992) as a superior predictor of intentions. Other researchers have
545 also considered the perceived controllability construct that reflects the extent to which
546 individuals perceive the performance of behaviours as separate facets of PBC (Rodgers et al.,
547 2008). However, this does not account for significant variance in violation intentions (Elliot
548 & Thomson, 2010). Given that different aspects of control have differential importance

549 across different contexts (Rodgers et al., 2008), it can be argued that this field of research will
550 benefit from more studies that assess multiple facets of PBC.

551 Moral norms added to the predictions of intentions when controlling for the basic
552 components of the TPB. This supports previous TPB studies (Conner et al., 2007; Elliot &
553 Thomson, 2010), which further highlights the potential importance of moral norms for traffic
554 behaviours. Nonetheless, depending on the types and motives of violation behaviours, people
555 may interpret traffic violations as (non) normative actions (Havârneanu & Havârneanu,
556 2012), which may have important moral underpinnings (Holman & Popusoi, 2018). Further
557 studies are needed to determine the extent to which a moral perspective relates to obedience
558 to traffic rules. It is interesting that past behaviours were not relevant predictors in the present
559 case, suggesting that such violation behaviours are less habitual. Nevertheless, in cases where
560 past behaviour acts as a determinant, it may be difficult to implement appropriate
561 interventions to address its influence (Chorlton et al., 2012). Another finding is that crash
562 history was related to a lower intention to avoid a violation. This could be that drivers with a
563 crash history might become habituated to the dangers and tended to underestimate risks
564 (Ngueutsa & Kouabenan, 2017). Our findings suggest the potential role of a history of
565 crashes as an important indicator of driver's behavioural profile that makes subsequent
566 crashes more likely. This is consistent with research reporting that errors and violations
567 factors predicted accidents prospectively and retrospectively (see de Winter & Dodou, 2010).
568 As with any cross-sectional study, caution must be exercised in relation to attributing
569 causality of the present findings. Further support needs to be provided through longitudinal
570 data.

571 Extending the findings of previous work-family studies in the safety field, it was
572 found that work-family conflict emerged as a significant between-person variable, suggesting
573 that the intention to avoid violation weakened as work-family conflict increased. This can be

574 explained through the lens of self-regulatory failure assumption (Baumeister & Heatherton,
575 1996), in that individuals with higher work-family conflict may experience self-regulation
576 breakdown because holding multiple roles may require them to use their resources to regulate
577 and suppress emotions other than managing the limited time and energy. Such situations may,
578 in turn, impair the motivation to take safety measures into driving-related tasks. Similarly,
579 many researchers support the assumption of saving time and energy as the prevalent reason
580 for traffic violations under time pressure (Lawton et al., 1997; Salminen, & Lähdeniemi,
581 2002). Another possible explanation for the hedonism principle may include the idea that
582 stressed drivers (i.e. those with competing roles) are motivated to escape from unpleasant
583 feelings by shifting their attention to immediate rewards while ignoring long-term
584 implications (Heatherton & Wagner, 2011), perhaps as a form of coping. Forward (2006)
585 pointed out that drivers who committed specific violations (speeding) reported perceived
586 gains (i.e. getting to the destination faster) rather than perceived negative outcomes such as
587 traffic crashes.

588 In line with this hypothesis, substantial support for the mediating model was obtained.
589 Thus, a contribution of the present study to the literature is that our findings clarify the role of
590 stressors within the TPB in the context of traffic violations. As discussed earlier, unlike work-
591 family conflict that is directly linked to intention, the influence of perceived stress is less
592 straightforward. When modelled simultaneously, the effect of perceived stress was fully
593 mediated by cognitive attitudes. Our study suggests that an important way in which proximal
594 stress perception may lead to a weaker intention is by lessening positive attitudes towards
595 traffic obedience. This corroborates a study (Hu et al., 2013) that found that drivers with a
596 negative emotional state could not rationally form an appropriate attitude and were likely to
597 drive dangerously. Additionally, work-family conflict was related to a lower propensity to
598 obey traffic rules, partly mediated by the lower level of social pressure to comply with traffic

599 laws. This is in line with the evidence indicating that selective biases in attention that occur in
600 response to stress may lead to neglect of social influences (Driskell et al., 1999), increasing
601 individual self-focus (Baumeister, 1984) and promoting egoistic intentions (Starcke et al.,
602 2011) in the driving setting. Importantly, the effects of both work-family conflict and
603 perceived stress on intentions were largely mediated by PBC components. It is evident that
604 stressors have the ability to hinder self-efficacy and impair the sense of internal control,
605 thereby reducing the motivation to follow traffic law. This supports the assumption that
606 control is a key mediator of stressful experiences in various domains (Steinbeis et al., 2015).
607 Further, the partial mediating role of moral norms suggests moral norms as a mechanism
608 through which work-family conflict leads to less intent in traffic obedience.

609 Finally, although assessing traditional variables to explain violation was not the main
610 objective of this study, the results showed that between-person variables, particularly gender,
611 added to the prediction of intentions. These findings align with previous studies, which
612 indicated that male drivers committed traffic violations more often (González-Iglesias et al.,
613 2012; Parker et al., 1995) and had lower intentions to avoid violations than did female drivers
614 (Atombo et al., 2016). Supporting a previous study (Sadeek et al., 2019), longer commuting
615 hours are also related to reduced intention to avoid violation, partly because of driver fatigue
616 (Häkkinen & Summala, 2001) and time reasons. Thus, intervention programs should target
617 these specific populations.

618 This study has several limitations. The generalisability of the current study is limited
619 by the use of convenience sampling techniques. A potential avenue for further studies would
620 be to replicate this study using a national probability sample. Given that cross-national
621 studies suggest variations in TPB components (Hassan et al., 2016) and cultural differences
622 in stressors (Allen et al., 2020), it would also be worthwhile to confirm the present findings
623 using samples originating from different countries and cultures. Future studies should

624 primarily focus on overcoming the limitations of self-report measures, where data are
625 vulnerable to a number of biases, including socially desirable responses. Although not always
626 practical, the use of observation/naturalistic behavioural assessments (e.g. driving simulators)
627 and physiological stress measures (e.g. heart-rate monitor and cortisol reactivity) may be
628 useful to address this drawback. In addition, as noted earlier, the present study used a cross-
629 sectional design that does not permit conclusions about causality. It would be valuable for
630 future longitudinal designs to shed light on the temporal sequencing of the variables specified
631 in this study. Additionally, a dynamic study is recommended to examine within-person
632 effects (i.e. daily fluctuations) of social cognition factors, stressors, and actual violation
633 experiences. Additional theoretically relevant variables (e.g. personal characteristics), which
634 might serve as alternative, third variable explanations of the obtained stress-intention findings
635 were not assessed and should be a focus of future work. Previous studies for instance,
636 suggests that personality traits (i.e. impulsivity, risk taking, hostility) were important
637 variables contributing to stress reactions (Finy et al., 2014) and various unsafe outcomes
638 including traffic violations (Bıçaksız, & Özkan, 2016). The present findings require
639 replication with reference to other types of violations, including disobeying traffic signs,
640 driving under the influence of drugs or alcohol, and using mobile phones while driving.
641 Because there is a possibility that violations are also often carried out outside commuting
642 (Tseng, 2013), further research should further examine the current framework within non-
643 commuting context such as leisure purposes. Finally, because our study did not consider the
644 differences between the dual nature of work-family conflict (Allen et al., 2020), it remained a
645 matter of future study to address this gap.

646 **5. Practical implication**

647 Importantly, it is worthwhile to consider the practical implications of this study for
648 developing broader and longer-term safety education strategies focusing on multiple violation

649 behaviours aiming to prevent commuting crashes. Therefore, we recommend that the
650 government incorporate the rational-based explanations offered by the TPB into such
651 programs, targeting social norms, personal attitudes, internal control, and moral norms to
652 bolster intentions to comply with traffic rules and ultimately reduce driving violations. While
653 educational programmes represent one of the core road safety measures, the efficiency of
654 these programs in changing traffic related behaviours is still rather unclear (Topolšek et al.,
655 2019). In fact, a number of studies reported the opposed and unintended effects of
656 educational intervention (Glendon et al., 2014; Poulter & McKenna, 2010). This highlights
657 the needs for further work to refine and extend existing safety education approaches to
658 enhance our knowledge of the benefits of these interventions. Still, evidence on TPB
659 intervention studies (Cuenen et al., 2016; Cutello et al., 2020; Floreskul et al., 2016; Stead et
660 al., 2005; Steinmetz et al., 2016) exists claiming some promising results. In keeping with
661 suggestions raised by Glendon et al. (2014), before every intervention, a pilot evaluation
662 assessment may be of crucial importance to identify any potential threat of unintended effects
663 and to improve any theoretical based components that was not tapped in the concrete
664 intervention materials (Stibe, & Cugelman, 2016).

665 From a theoretical perspective, our study sheds further light on the underlying
666 processes by which contextual factors (i.e. specific stressors versus overall life stress) may be
667 implicated in increasing the tendency to commit traffic violations. Our results provide a new
668 insight into how stressors embedded within a particular context (i.e. work-family conflict)
669 have a potential direct threat to road safety during commuting, adding it to the list of
670 psychological stressors known to influence traffic offences. Understanding this process could
671 help identify specific stressors tied directly to work and family roles, which eventually lead to
672 more appropriate road crash prevention. Therefore, steps are needed to create awareness of
673 the carryover effects of work and family pressures on the driving environment. Strengthening

674 work-life policies at national and organisational levels would be an important target to reduce
675 the negative exposure to work-family conflict, which has the potential to increase commuting
676 safety behaviour. This would also point to the need to expand the investigations of effective
677 policies that promote work-life balance and thus minimise potential spillover effects of the
678 work and family domains into driving areas.

679 The indirect effect of stressors on intention formation by influencing the socio-
680 cognitive components could be a potential target for prevention and intervention. Efforts are
681 needed to incorporate, for example, stress management and relaxation skills to foster
682 emotional capacity to cope with daily stressful encounters and target the strengthening of
683 social cognition factors. In particular, because self-regulatory failure may play a role in the
684 stress process (Beimester & Heatherton, 1996), consistent with the suggestions of Gwyther
685 and Holland (2012), there may be significant advantages in incorporating self-regulatory
686 skills as a potential risk management strategy to reduce traffic violations.

687 **6. Conclusion**

688 This study has advanced our knowledge of traffic violations by strengthening the explanatory
689 effect of the TPB by adding stressors to understand the individual motives behind commuting
690 violation prevention. It presents compelling evidence that TPB components explain a
691 substantial part of the variance in intentions. In particular, work-family conflicts can directly
692 influence intentions. Of particular relevance is the mediation of social cognition variables
693 between stressors and intentions, supporting the idea that psychological stressors play an
694 important role in intention formation in traffic violation situations. We believe that our study
695 suggests an important line of research in attempting to test the hypothetical links among
696 stressors, the social cognition model, and road safety outcomes for commuting employees.

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699

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Table 1

1058 Description of respondents' demographic data ($N_{\text{participants}} = 482$)

Variables	Description	Frequency	Percentage
Gender	0: Male	215	44.6%
	1: Female	267	55.4%
Age	1: 18-25	72	14.9%
	2: 26-30	75	15.6%
	3:31-40	168	34.9%
	4:41-50	114	23.7%

	5: 50>	53	11.0%
Marital status	0: Single	118	24.5%
	1: Married	364	75.5%
Driving experience	1: Less than 5 years	69	14.3%
	2: 6 to 15 years	195	40.5%
	3: 16 > years	218	45.2%
Driving hours	1: less than 30 min	257	53.3%
	2: 30 min to 60 min	162	33.6%
	3: 60 min to 90 min	40	8.3%
	4: 90> min	23	4.8%

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10. Crash history	-.21**	-.22**	-.16**	-.21**	-.03	-.18**	.15*	-.14**	.03	-								
11. Gender ^a	.12**	.15**	.13**	.13**	-.02	.04	-.06*	.09*	.00	-.16**	-							
12. Age	.10**	.17**	.16**	.11**	.07**	.16**	-.14**	.13**	-.04	-.17**	-.29**	-						
13. Status ^b	.05	.10**	.08**	.07**	.03	.09**	-.06**	.06*	-.00	-.13**	.03	.54**	-					
14. Experience	.09*	.16**	.16**	.10*	.07*	.15**	-.11*	.13**	.00	-.15**	-.15**	.64**	.50*	-				
15. Hour ^c	-.09*	-.02	-.02	-.06	.00	.01	.04	.00	-.00	-.03	-.01	.13**	.14**	.10	-			
16. Stress	-.10**	-.09**	-.05*	-.10**	-.09**	-.12**	.12**	-.05	.00	.12**	.08**	-.17**	-.07*	-.16**	.00	-		
17. WFC	-.13**	-.12**	-.09*	-.11**	-.07*	-.14**	.19**	-.07**	.02	.15**	-.02	-.01	.03	.01	.05	.36**	-	
Mean	5.16	5.55	5.15	5.24	3.95	5.24	2.56	5.03	1.59	0.46	0.50	36.7	0.49	15.43	0.47	25.46	29.12	
SD	1.92	1.91	1.84	1.92	1.75	1.90	1.59	2.09	1.04	1.29	0.50	10.0	0.50	9.04	0.50	5.72	9.52	

1069 Note: Status = marital status; Hours = driving hours; Stress = perceived stress; WFC = work-family conflict; ^a(0= man, 1 = woman); ^b(0 =
1070 single, 1 = married); ^c(0= less than 30 minutes, 1 = more than 30 minutes); Within-person variables (N_{observations} = 1446), Between-person
1071 variables (N_{participants} = 482); For within-person by between-person correlations, we repeat the between variables for each behaviour (then *r* is
1072 based on 3 x N).

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1074 **Table 3**

1075 Hierarchical multi-level regressions of intention onto predictors

Predictors	Step 1 Model			Step 2 Model			Step 3 Model		
	B	SE	β	B	SE	β	B	SE	β
Intercept (γ_{00})	5.16	0.07		5.16	0.07		5.16	0.04	
Age (γ_{01})	0.00	0.01	0.02	0.00	0.01	0.00	-0.00	0.00	-0.03
Gender (γ_{02})	0.51	0.14	0.13***	0.52	0.14	0.13***	0.10	0.10	0.02
Marital (γ_{03})	-0.04	0.19	0.01	-0.01	0.19	0.00	-0.04	0.13	-0.00
Experience (γ_{04})	0.02	0.01	0.10	0.02	0.01	0.01	0.00	0.01	0.03
Hours (γ_{05})	-0.28	0.14	0.07*	-0.26	0.14	0.06	-0.12	0.09	0.03
Perceived stress (γ_{06})				-0.01	0.01	-0.05	-0.00	0.00	-0.00
Work-family conflict (γ_{07})				-0.02	0.00	-1.10**	-0.00	0.00	-0.02
Cognitive attitude (γ_{10})							0.08	0.02	0.08**

Affective attitude (γ_{20})	0.08	0.03	0.08**
Injunctive norm (γ_{30})	0.35	0.02	0.35***
Descriptive norm (γ_{40})	0.06	0.02	0.05**
Self- efficacy (γ_{50})	0.10	0.02	0.10***
Perceived difficulty (γ_{60})	-0.09	0.02	-0.07***
Moral norm (γ_{70})	0.05	0.02	0.05**
Past behaviour (γ_{80})	0.00	0.02	0.00
Crash history (γ_{90})	-0.08	0.03	-0.05*

1076 Note. B = unstandardized coefficient; β = standardized coefficient; SE = standard error; Experience = driving experience; Hours = Commuting
1077 hours; Intercept only model at Step 0, Deviance = 5565.09; Step 1 model, Deviance = 5540.81, $\Delta \chi^2(5) = 24.28$, $p < .001$; Step 2, Deviance =
1078 5526.38, $\Delta \chi^2(2) = 14.42$, $p < .001$; Step 3, Deviance = 5016.41, $\Delta \chi^2(9) = 509.97$ $p < .001$. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

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Appendix

The theory of planned behaviour

Intentions

I intend to refrain from driving above the posted speed limit, while driving to and from work over the next two weeks (*strongly disagree–strongly agree*).

I will try to refrain from driving above stated speed limit, while driving to and from work over the next two weeks (*strongly disagree–strongly agree*).

Attitude

For me, to refrain from driving above the posted speed limit while driving to and from work would be...

(*foolish–wise; harmful–beneficial*)

(*not enjoyable–enjoyable; unpleasant–pleasant*)

Injunctive norm

Most people who are important to me think I should refrain from driving above the posted speed limit, while driving to and from work (*strongly disagree–strongly agree*).

Most people who are important to me want me to refrain from driving above the posted speed limit, while driving to and from work (*strongly disagree–strongly agree*).

Descriptive norms

I think most people who are important to me refrain from driving above the posted speed limit, while driving to and from work (*strongly disagree–strongly agree*)

I think most people I know refrain from driving above the posted speed limit, while driving to and from work (*extremely unlikely –extremely likely*)

PBC

If it were entirely up to me, I am confident that I could refrain from driving above the posted limit, while driving to and from work (*strongly disagree–strongly agree*).

How difficult is it to refrain from driving above the stated speed limit when you are really in a hurry, while driving to and from work? (*very easy–very difficult*).

How difficult is it to refrain from driving above stated speed limit while commuting when you are in a bad mood, while driving to and from work? (*very easy–very difficult*).

Additional predictors

Moral norms

It will be quite wrong for me to drive above the posted speed limit while driving to and from work (*definitely no–definitely yes*).

Past behaviours

In the past, I frequently drove above the posted speed limit, while driving to and from work (*strongly disagree–strongly agree*)

To what extent have you been driving above the posted speed limit in the past, while driving to and from work (*not at all– all the time*)

History of traffic crash

How many times were you involved in a traffic crash by driving above the posted speed limit in the past two years (*0–more than seven times*)

Perceived stress scale^a

How often have you been upset because of something that happened unexpectedly?

How often have you felt that you were unable to control the important things in your life?

How often have you felt nervous and stressed?

How often have you felt confident about your ability to handle your personal problems?

How often have you felt that things were going your way?

How often have you found that you could not cope with all the things you had to do?

How often have you been able to control irritations in your life?

How often have you felt that you were on top of things?

How often have you been angered because of things that happened that were outside of your control?

How often have you felt difficulties were piling up so high that you could not overcome them?

Work-family conflict^b

My work keeps me from my family activities more than I would like.

The time I must devote to my job keeps me from participating equally in household responsibilities and activities.

I have to miss family activities due to the amount of time I must spend on work responsibilities.

The time I spend on family responsibilities often interfere with my work responsibilities.

The time I spend with my family often causes me not to spend time in activities at work that could be helpful to my career.

I have to miss work activities due to the amount of time I must spend on family responsibilities.

When I get home from work I am often too frazzled to participate in family activities/responsibilities.

I am often so emotionally drained when I get home from work that it prevents me from contributing to my family.

Due to all the pressures at work, sometimes when I come home I am too stressed to do the things I enjoy.

Due to stress at home, I am often preoccupied with family matters at work.

Because I am often stressed from family responsibilities, I have a hard time concentrating on my work.

Tension and anxiety from my family life often weakens my ability to do my job.

Note: ^a(never–very often); ^b(strongly disagree– strongly agree).