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Impulsivity, Conformity Based Overtime Pressure, and Driving Distraction among Employee Car Commuters in Shandong, China: Implications for Road Safety Education

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Research Article

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Abstract

Employee commuting links workplace conditions to a safety critical transport task, but personal and workplace correlates may show different associations with distraction and road behaviour. This post hoc secondary analysis used an archive of 492 employee car commuters recruited with organisational assistance across 16 cities in Shandong, China. Primary gender adjusted models included 490 respondents and controlled for age, recorded gender, and driving experience. Scores were rebuilt from raw items. HC3 inference, Holm adjustment, and 10,000 case resampled coefficient products were used. Impulsivity was positively associated with Errors and Violations, Lapses, and Aggressive Violations after Holm adjustment, but its association with Driving Distraction was unclear (B = .092, p = .129). Conformity Based Overtime Pressure was associated with Driving Distraction (B = .183, p < .001), Errors and Violations, and Lapses; its total and conditional associations with Aggressive Violations were uncertain. Coefficient product intervals through distraction were above zero for overtime pressure across the three outcomes, whereas all corresponding impulsivity intervals included zero. The findings showed different observed patterns of statistical support for a personal self regulation correlate and a social evaluative workplace correlate, although formal coefficient contrasts did not establish systematic magnitude differences after Holm adjustment. They provide a rationale for prospectively evaluating road safety education alongside workplace practices that protect the transition from work to driving. Cross sectional self reports cannot establish causal pathways, objective driving risk, or educational effectiveness.

Introduction

Road injury remains a major transport safety burden. The World Health Organization estimates that 1.19 million people die on the world's roads each year and identifies road traffic injury as a leading cause of death among people aged 5–29 years (World Health Organization, 2023). European road safety policy treats distraction and safe road use within a layered Safe System rather than as matters of driver responsibility alone (European Commission, 2019). Employee car commuters warrant attention because the end of a work period is followed by a task that demands sustained attention, self regulation, and adaptation to traffic.

Work experiences do not necessarily end when employees leave the workplace. End of day job strain and work related rumination have been studied in relation to commuting safety behaviour, and workplace incivility has been linked to aggressive behaviour on the journey home (Burch & Barnes-Farrell, 2020; Burch et al., 2023). Overtime is not a single exposure: worktime control, voluntariness, autonomy, workload, and social expectations can differ (Watanabe & Yamauchi, 2016; Yang et al., 2023; Yu & Leka, 2022a, 2022b). This study isolates a narrower social evaluative condition: discomfort about leaving while managers, senior staff, or colleagues remain. We call it Conformity Based Overtime Pressure. It is not a measure of hours worked, fatigue, electronic availability, rumination, or formal overtime policy.

The work to driving transition matters for transport systems because commuting safety is shaped across organisational, behavioural, vehicle, and road contexts. The present Chinese archive cannot estimate European prevalence or support direct policy transfer. It can test a transport relevant distinction that can be replicated in European settings: whether a personal self regulation correlate and a workplace social evaluative correlate show different profiles with a more proximal attention related variable and self reported road behaviour. This comparison can inform the design of prospective studies before employer mobility management or educational programmes are evaluated.

Commuting is a repeated exposure rather than a single isolated journey. A modest questionnaire association may therefore identify a useful research target without specifying how often a behaviour occurs on the road or how much risk it carries on any one trip. Frequency, distance, traffic density, route complexity, time of day, and vehicle systems could all change the transport meaning of the same reported tendency. The archive records broad commuting frequency and distance, but its road behaviour items are not restricted to commuting events and the exposure fields contain high values. This mismatch informed the covariate strategy. It also prevents conversion of regression coefficients into crash probability, attributable burden, or a forecast for a particular route.

Driving Distraction was the proximal attention related variable. Distraction occurs when attention needed for driving is diverted towards a competing activity, and context can shape engagement with mobile phones and other secondary tasks (Cuentas-Hernandez et al., 2024; Regan et al., 2011). Daily research has linked workday experience with smartphone use during the commute home, while recent European Transport Research Review work has examined attentional diversion in controlled driving research (Mazeres et al., 2025; Tommasi et al., 2023). Together, these studies illustrate why timed work and journey measures are valuable. The archive used here did not record thoughts, work messages, departure time, road segment, or a time stamped work to road sequence. Driving Distraction is therefore a concurrent self report correlate in a statistical decomposition, not an observed mechanism.

The outcomes were sample specific content scores inherited from the Driver Behaviour Questionnaire tradition. That tradition distinguishes errors, lapses, and violations, but structures vary across settings and do not substitute for crashes or naturalistic records (de Winter & Dodou, 2010; Lajunen et al., 2004; Parker et al., 1995; Reason et al., 1990). Recent Chinese naturalistic research and an ETRR study linking questionnaire dimensions to instrumented road behaviour both underline the need for external validation (Dourado et al., 2026; Jiao et al., 2023). We therefore use self reported road behaviour rather than objective risk and retain the inherited score names Errors and Violations, Lapses, and Aggressive Violations.

Impulsivity provides the personal comparison. Impulsivity like and sensation seeking tendencies have been associated with self reported driving behaviour in international and Chinese samples (Dahlen et al., 2005; Ge et al., 2020; Li et al., 2023; Pearson et al., 2013; Qu et al., 2020; Tao et al., 2017; Yang et al., 2013; Zhang et al., 2019). The archive score contains substantial positive urgency content (Cyders et al., 2007) and one restlessness or sensation related item. It is treated as a thesis final impulsivity composite, not as a pure Positive Urgency scale or a diagnostic trait.

The conceptual contribution is a comparison between two levels of prevention relevant correlate. Impulsivity represents a personal self regulation background, Conformity Based Overtime Pressure represents a workplace social evaluative condition, and Driving Distraction is closer to the driving task. A four item Mixed Multitasking and Work Integration Orientation score was explored only as a supplementary boundary condition because it joins perceived multitasking confidence with work integration content and is not a validated polychronicity, ability, or behaviour measure (Howard & Cogswell, 2023; Reinke & Gerlach, 2022; Richardson & Benbunan-Fich, 2011).

Two aims guided this post hoc focused secondary analysis. Aim 1 compared the adjusted associations of impulsivity and Conformity Based Overtime Pressure with Driving Distraction and with each road behaviour score before and after adding distraction. Aim 2 estimated cross sectional coefficient products through distraction while retaining the total and conditional associations. The focused sequence and multiplicity families were specified before the final rerun, while results from the parent doctoral study had already been visible; the aims are not preregistered or confirmatory.

Methods

Study Design, Setting, and Participants

The thesis reports 1,000 invitations, 668 returned questionnaires, 176 exclusions during its screening process, and 492 retained cases. The fixed archive available for reanalysis comprised only the final 492 employee car commuters recruited with organisational assistance across 16 cities in Shandong Province, China. The thesis describes a broader staged sampling plan, but the retained materials do not justify an individual probability or province representative claim. Because the case level records for the 176 exclusions were not retained, their eligibility and quality decisions cannot be reconstructed independently. Reporting follows STROBE principles for observational studies (von Elm et al., 2007).

The archive included 226 respondents in the male response category, 264 in the female response category, one non binary respondent, and one respondent who selected prefer not to say. Primary gender adjusted analyses included the 490 respondents in the male or female response categories. The two small categories remained in descriptive summaries and an N = 492 sensitivity without gender; they were not combined into a synthetic category. Table 1 describes the archive and analytic samples.

Table 1
Participant Characteristics and Analytic Samples

Characteristic	Archive (N = 492)	Primary (N = 490)
Archive records	492	—
Primary gender adjusted sample	—	490
Male response category, n (%)	226 (45.9)	226 (46.1)
Female response category, n (%)	264 (53.7)	264 (53.9)
Non binary response category, n (%)	1 (0.2)	—
Prefer not to say, n (%)	1 (0.2)	—
Age, years, M (SD)	43.86 (6.76)	43.86 (6.77)
Driving experience, years, M (SD)	13.87 (6.72)	13.84 (6.71)
Commuting frequency, median (IQR)	6 (5–7)	6 (5–7)
Commuting distance, median (IQR)	10 (6–20)	10 (6–20)

Note. Primary models included the male and female response categories. The two very small categories remained in archive descriptions and the N = 492 no gender sensitivity; they were not combined.

The analysis uses a single cross sectional questionnaire wave. The retained SAV contained complete values for all focal raw items and the primary covariates, so no model based imputation was required. Age ranged from 21 to 68 years and driving experience from 1 to 39 years. The unit recorded for commuting duration could not be established from the archived files and was not used in primary adjustment. These decisions were made to preserve the fixed archive and to avoid case or variable selection based on statistical significance. They also make the analytic denominator explicit for every primary estimate and sensitivity model.

Questionnaire Adaptation

The fixed thesis documents independent forward translation of the English source material into Chinese, reconciliation of the translated versions, back translation, and bilingual review of discrepancies. The reconciled questionnaire was piloted with 30 respondents to assess clarity and completion before the main data collection. These steps describe the adaptation route preserved in the thesis; they do not establish cross language measurement invariance or substitute for independent validation. Source discrepancies and score lineage are reported in Supplementary Tables S1–S3.

Measures

Impulsivity. The mean of Q12–Q23 and Q26 formed the 13 item thesis final composite. Most items concern acting rashly during intense positive affect; Q26 concerns restlessness after spending too much time at home. Responses ranged from 1 (Strongly Disagree) to 5 (Strongly Agree). No item was reverse scored. Higher scores indicate more impulsive content in this inherited composite, not a pure Positive Urgency construct.

Conformity Based Overtime Pressure. The mean of Q97–Q100 captured discomfort or reluctance to leave while managers, senior staff, or colleagues remained. Responses ranged from 1 (Strongly Disagree) to 5 (Strongly Agree), and no item was reversed. The score does not measure overtime hours, fatigue, workload, supervisor conduct, or electronic availability.

Driving Distraction. The seven item mean used Q155 and Q157–Q162. The behaviours were reading or sending text messages; consuming food or beverages; consulting or entering navigation directions; selecting or changing music; accessing the internet or social media; reading books, electronic books, or work documents; and searching for objects such as work materials. Q156 concerned passenger interactions and was excluded. Responses ranged from 1 (Strongly Disagree) to 5 (Strongly Agree), and no item was reversed.

Self reported road behaviour. Errors and Violations was the mean of Q187–Q196, Q198, and Q201; Lapses averaged Q199 and Q202–Q204; Aggressive Violations averaged Q179–Q181. These frequency items ranged from 1 (Never) to 5 (Always), and none was reverse scored. Higher values denote more frequent endorsed content. The scales are sample specific inherited scores rather than the complete Driver Behaviour Questionnaire or objective risk measures.

Measurement checks. All scores were reconstructed from raw items. Cronbach's alpha and omega described internal consistency. Alpha estimates were .939 for Impulsivity, .822 for Conformity Based Overtime Pressure, .858 for Driving Distraction, .948 for Errors and Violations, .879 for Lapses, and .805 for Aggressive Violations; corresponding omega estimates ranged from .822 to .954. Separate score level Kaiser–Meyer–Olkin and Bartlett tests and one component principal component summaries are reported in Supplementary Table S2. The analyses describe internal structure in the same sample and are not confirmatory factor analysis or evidence of external validity. Historical item deletion material, source wording conflicts, and legacy composite reconciliation are confined to Supplementary Table S3 because they did not change the fixed focal formulas. Exact item maps, anchors, observed ranges, missing declarations, and reversal decisions appear in Supplementary Table S1.

Statistical Analysis

Primary adjustment was selected before examining the final rerun's p values. Model A adjusted for age, the recorded male versus female response category contrast, and years of driving experience. Model B added log(1 + commuting frequency) and log(1 + commuting distance) as an exposure adjusted sensitivity. Model A was primary because the outcomes refer to general road behaviour rather than commute specific events and because the exposure fields

contained marked high values (frequency 1–75; distance 1–430). Raw, log transformed, and winsorised exposure variants are in Supplementary Table S8. Commuting duration was not a primary covariate because its unit was ambiguous.

Driving Distraction was first regressed on impulsivity, Conformity Based Overtime Pressure, and the Model A covariates. For each road behaviour outcome, a total association model contained both focal predictors and the covariates but not distraction; a conditional model then added distraction. Cross sectional indirect associations were products of the jointly adjusted predictor to distraction and distraction to outcome coefficients. Percentile intervals used 10,000 case resamples. A 95% interval was primary, and a Bonferroni adjusted 98.33% percentile interval provided a conservative three outcome sensitivity (Hayes, 2022). Supplementary Table S4 gives the interval details.

Ordinary least squares coefficients are reported with HC3 standard errors and confidence intervals (Long & Ervin, 2000). Holm adjustment was applied to predefined families: each focal predictor across the three total models, each focal predictor across the three conditional models, and Driving Distraction across the three conditional models (Holm, 1979). Seven formal equality contrasts compared the standardised impulsivity and overtime pressure coefficients in the distraction model and in the three total and three conditional outcome models. These contrasts used the same N = 490, Model A covariates, and HC3 covariance, with Holm adjustment across all seven. Raw and adjusted p values are retained. Complete coefficients and contrasts are in Supplementary Tables S5 and S12.

The available archive fixed the analytic sample; recruitment was not determined by a prospective power calculation for this secondary analysis. Interpretation therefore emphasises estimates, confidence intervals, multiplicity control, and agreement across prespecified specifications rather than a post hoc power value. Standardised coefficients accompany unstandardised estimates in Table 3 so that scale dependent and relative magnitudes can be read together. No model, covariate set, or outcome was selected because it produced a smaller p value.

Table 3

Adjusted Total and Conditional Associations with Distraction and Road Behaviour

Model	Focal term	B	HC3 SE	β	95% CI	Raw p	Holm p	R^2	Adj. R^2	ΔR^2 after DD
Driving Distraction model	Impulsivity	0.092	0.061	0.085	[−0.027, 0.211]	.129	—	0.082	0.072	—
	Conformity Based Overtime Pressure	0.183	0.053	0.204	[0.079, 0.287]	< .001	—			
Errors and Violations: total	Impulsivity	0.211	0.050	0.220	[0.113, 0.308]	< .001	< .001	0.188	0.180	—
	Conformity Based Overtime Pressure	0.183	0.039	0.231	[0.107, 0.259]	< .001	< .001			
Errors and Violations: conditional	Impulsivity	0.183	0.043	0.192	[0.098, 0.268]	< .001	< .001	0.292	0.283	0.103
	Conformity Based Overtime Pressure	0.129	0.035	0.162	[0.061, 0.197]	< .001	< .001			
	Driving Distraction	0.296	0.041	0.335	[0.215, 0.377]	< .001	< .001			
Lapses: total	Impulsivity	0.366	0.055	0.330	[0.258, 0.474]	< .001	< .001	0.178	0.169	—
	Conformity Based Overtime Pressure	0.165	0.043	0.179	[0.080, 0.250]	< .001	< .001			
Lapses: conditional	Impulsivity	0.349	0.052	0.314	[0.246, 0.452]	< .001	< .001	0.209	0.200	0.031
	Conformity Based Overtime Pressure	0.130	0.042	0.142	[0.049, 0.212]	.002	.004			
	Driving Distraction	0.189	0.043	0.185	[0.104, 0.275]	< .001	< .001			
Aggressive Violations: total	Impulsivity	0.258	0.058	0.227	[0.144, 0.373]	< .001	< .001	0.133	0.124	—
	Conformity Based	0.093	0.050	0.098	[−0.007,	.067	.067			

Note. N = 490. Model A adjusts for age, the recorded gender contrast, and driving experience. Holm values are within the predefined three outcome family for the same focal term and stage. Complete control coefficients are in Supplementary Table S5.

Model	Focal term	B	HC3 SE	β	95% CI	Raw p	Holm p	R^2	Adj. R^2	ΔR^2 after DD
	Overtime Pressure				0.192]					
Aggressive Violations: conditional	Impulsivity	0.231	0.054	0.203	[0.125, 0.337]	< .001	< .001	0.205	0.195	0.072
	Conformity Based Overtime Pressure	0.039	0.050	0.041	[– 0.060, 0.137]	.443	.443			
	Driving Distraction	0.295	0.053	0.280	[0.191, 0.398]	< .001	< .001			

Note. N = 490. Model A adjusts for age, the recorded gender contrast, and driving experience. Holm values are within the predefined three outcome family for the same focal term and stage. Complete control coefficients are in Supplementary Table S5.

Diagnostics included variance inflation factors, tolerance, studentised residuals, leverage, Cook's distance, DFBETA, Breusch–Pagan and White tests, the Ramsey specification test, and a Durbin–Watson reproduction statistic. The last is descriptive because questionnaire row order is not a time series. No case was removed solely on an influence statistic. Supplementary Table S6 gives the diagnostics. Centred quadratic terms, Huber regression, and median regression are in Supplementary Table S7. Response quality rules and their strict subset are in Supplementary Table S9.

The four item Mixed Multitasking and Work Integration Orientation score and its joint interaction models were not treated as a main aim. For transparency, all six interaction tests, simple slopes permitted by the primary Holm criterion, and the strict response quality sensitivity are reported in Supplementary Table S9. The two pair content sensitivity is reported separately in Supplementary Table S10. These analyses are exploratory, measurement limited, and not suitable for individual classification.

Native IBM SPSS Statistics 26 reproduced raw score construction, alpha, separate score level principal component, Kaiser–Meyer–Olkin and Bartlett results, descriptives, correlations, ordinary least squares equations, standard diagnostics, and moderation preparation. Python 3.12 with pyreadstat, pandas, scipy, and statsmodels produced omega, HC3 inference, Holm values, 10,000 resample intervals, and robust and nonlinear sensitivities. Software provenance is in Supplementary Table S11, and the final numerical audit is in Supplementary Table S12. Python results are not represented as SPSS output.

Use of Generative Artificial Intelligence

During revision, a generative artificial intelligence tool supported statistical coding checks, reference verification, document production, and language editing. The authors remain responsible for the analyses, citations, and text; the tool is not an author.

Results

Sample and Measurement Characteristics

The archive mean age was 43.86 years (SD = 6.76; range 21–68), and mean driving experience was 13.87 years (SD = 6.72). Commuting frequency had a median of 6 (IQR 5–7), and commuting distance had a median of 10 (IQR 6–20). Table 1 presents the archive and analytic samples. In the primary sample, scale means ranged from 1.46 for Errors and Violations to 2.60 for Conformity Based Overtime Pressure. Floor proportions were 36.12% for Errors and Violations, 26.73% for Lapses, and 22.24% for Aggressive Violations. All six focal reliability estimates reported in the main analysis were reproduced from raw items. The score specific KMO values ranged from .661 to .965, every Bartlett test was significant, and the first component accounted for 54.6% to 73.8% of item variance. These same sample checks support arithmetic score description but not external construct validity. Reliability, distribution, and correlations are reported in Table 2; the measurement audit, including the supplementary mixed orientation score, is in Supplementary Table S2.

Table 2

Scale Properties, Descriptive Statistics, Reliability, Floor Concentration, and Pearson Correlations

Measure	Items	M	SD	α	ω	Floor %	1	2	3	4	5	6
1. Impulsivity	13	2.32	0.66	0.939	0.941	3.67	—	—	—	—	—	—
2. Conformity Based Overtime Pressure	4	2.60	0.80	0.822	0.824	4.69	0.236	—	—	—	—	—
3. Driving Distraction	7	2.44	0.72	0.858	0.861	3.88	0.146	0.218	—	—	—	—
4. Errors and Violations	12	1.46	0.63	0.948	0.954	36.12	0.301	0.284	0.399	—	—	—
5. Lapses	4	1.85	0.73	0.879	0.882	26.73	0.376	0.258	0.256	0.694	—	—
6. Aggressive Violations	3	1.84	0.75	0.805	0.822	22.24	0.277	0.149	0.331	0.605	0.506	—

Note. N = 490. Correlations are below the diagonal. Reliability used the full 492 record archive because no focal item was missing.

Adjusted Associations with Driving Distraction and Road Behaviour

Conformity Based Overtime Pressure was positively associated with Driving Distraction, B = .183, HC3 SE = .053, 95% CI [.079, .287], p < .001. The impulsivity coefficient was positive but imprecise, B = .092, SE = .061, 95% CI [− .027, .211], p = .129. The model explained 8.2% of the variance (adjusted R^2 = .072).

Before distraction was added, impulsivity was positively associated with Errors and Violations (B = .211), Lapses (B = .366), and Aggressive Violations (B = .258); all three remained supported after Holm adjustment. Conformity Based Overtime Pressure was associated with Errors and Violations (B = .183, Holm p < .001) and Lapses (B = .165, Holm p < .001), whereas its Aggressive Violations estimate was uncertain (B = .093, 95% CI [− .007, .192], raw and Holm p = .067). Total models explained 13.3% to 18.8% of outcome variance.

After distraction was added, impulsivity remained positively associated with all three outcomes. The overtime pressure coefficients remained positive for Errors and Violations (B = .129, Holm p < .001) and Lapses (B = .130, Holm p = .004), but were uncertain for Aggressive Violations (B = .039, 95% CI [− .060, .137], p = .443). Driving Distraction was positively associated with all three outcomes after Holm adjustment. Adding distraction increased R^2 by .103, .031, and .072, respectively. Table 3 retains every focal total and conditional estimate, including null results.

Cross Sectional Coefficient Products

The overtime pressure coefficient products through distraction were .054 for Errors and Violations, .035 for Lapses, and .054 for Aggressive Violations. Their 95% intervals and Bonferroni adjusted 98.33% percentile intervals were above zero. The corresponding impulsivity products were .027, .017, and .027; all three 95% intervals and all three 98.33% intervals included zero. Table 4 reports the products. The Aggressive Violations product does not convert the uncertain total or conditional overtime pressure coefficient into a causal or supported direct association.

Table 4
Cross Sectional Coefficient Products through Driving Distraction

Antecedent	Outcome	a path	b path	Product	95% percentile CI	98.33% percentile CI
Impulsivity	Errors and Violations	0.092	0.296	0.027	[− 0.006, 0.066]	[− 0.015, 0.075]
Conformity Based Overtime Pressure	Errors and Violations	0.183	0.296	0.054	[0.022, 0.091]	[0.017, 0.101]
Impulsivity	Lapses	0.092	0.189	0.017	[− 0.004, 0.046]	[− 0.009, 0.052]
Conformity Based Overtime Pressure	Lapses	0.183	0.189	0.035	[0.013, 0.063]	[0.009, 0.072]
Impulsivity	Aggressive Violations	0.092	0.295	0.027	[− 0.007, 0.067]	[− 0.014, 0.077]
Conformity Based Overtime Pressure	Aggressive Violations	0.183	0.295	0.054	[0.020, 0.096]	[0.015, 0.105]

Note. N = 490; 10,000 case resamples. The 98.33% intervals are Bonferroni sensitivities, not exact simultaneous intervals. Products are statistical decompositions, not causal effects.

Formal Equality Contrasts

The observed support patterns differed, but formal standardised coefficient contrasts did not establish systematic predictor magnitude differences. Raw contrast p values ranged from .009 to .877; after Holm adjustment across seven contrasts, none was supported (Holm p range .065–1.000). The smallest adjusted value occurred for the Lapses conditional model. Supplementary Table S12 reports all seven contrasts alongside the independent numerical audit.

Sensitivity and Diagnostics

Model B and the raw, log transformed, winsorised, no gender, historical score, duration, Huber, median, and quadratic checks preserved the main directions. No focal quadratic term was supported, but the specification test was significant for all three conditional equations; interpretation therefore remains associational and modest. Variance inflation factors were at most 1.263 and tolerance was at least .792. Breusch–Pagan tests indicated

heteroscedasticity for Errors and Violations and Lapses, and White tests did so for all three equations. Supplementary Tables S6–S8 provide the complete results. Exploratory mixed orientation interactions were specification sensitive and are confined to Supplementary Tables S9–S10.

Discussion

The two aims yielded different observed patterns of statistical support. Conformity Based Overtime Pressure was associated with Driving Distraction, while impulsivity was not clearly associated with distraction. Impulsivity was positively associated with all three road behaviour scores. Overtime pressure was associated with Errors and Violations and Lapses; its Aggressive Violations estimates remained uncertain. Coefficient products through distraction were above zero for overtime pressure but included zero for impulsivity. Formal standardised coefficient contrasts did not establish systematic magnitude differences after Holm adjustment, so these findings concern patterns of support rather than proof that one predictor was generally stronger than the other.

The clearest workplace finding was the association between overtime pressure and distraction. Work to driving research suggests that work experiences can accompany commuting behaviour (Burch & Barnes-Farrell, 2020; Burch et al., 2023), but the present score is narrower than strain, fatigue, or hours. Its four items record social unease about timely departure; they do not identify supervisors, work messages, rumination, or a specific event before driving. The products are compatible with a statistical decomposition in which distraction co occurs with both overtime pressure and road behaviour. They do not establish temporal ordering or a mechanism. Retaining the null Aggressive Violations total and conditional results alongside its above zero product is essential to avoid overstating consistency.

Impulsivity followed a different pattern. Its distraction estimate was imprecise, yet it related consistently to Errors and Violations, Lapses, and Aggressive Violations before and after distraction was added. That profile is compatible with research on impulsivity like and sensation seeking tendencies in self reported driving behaviour, including Chinese samples, but the instruments and outcomes differ (Ge et al., 2020; Li et al., 2023; Tao et al., 2017; Zhang et al., 2019). The findings do not support a simple Impulsivity to Distraction account and do not justify treating the 13 items as a diagnostic trait or pure Positive Urgency.

The distinction between observed profiles is useful for transport research even though neither profile is causal and the equality tests were inconclusive after correction. A personal correlate may remain associated with broad road behaviour without appearing clearly in the selected distraction score. A workplace correlate may relate to distraction while showing weaker or outcome dependent total associations. This means that a single educational message is unlikely to represent the entire observed pattern. It also means that the workplace result should not be enlarged into a claim about fatigue or excessive hours, constructs that were not measured. Prospective studies should align each construct with a timed workday exposure and a specific subsequent journey before asking whether workplace practice and driver education add independent value.

Implications for Transport Safety and Road Safety Education

For transport safety research, the contribution is a distinction between levels of correlate rather than an intervention claim. A proximal attention related score was associated with all three road behaviour outcomes, whereas the personal and workplace predictors had different relations with that score. Prospective studies could measure the final work hour, departure, journey exposure, in vehicle secondary tasks, and near crashes in sequence. Experience sampling or linked naturalistic driving could test whether workplace social pressure precedes distraction during specific commutes.

The Chinese setting limits direct application, but the question is relevant to European transport practice. European road safety policy treats distraction, training, and safety at work participation within shared responsibility (European Commission, 2019). Replication could compare worktime control, timely departure norms, commuting arrangements, and road contexts across European settings. Measurement invariance should precede cross national coefficient comparisons, and private car commuting should remain distinct from professional driving.

The results suggest three candidate components for controlled road safety education research. First, the distraction associations support prospectively evaluating single task attention protection and pre drive preparation, such as completing navigation entry and pausing reading or online activity before the vehicle moves. Existing intervention evidence is promising but methodologically uneven (Nicolls et al., 2024). Second, the overtime pressure association with distraction supports evaluating supervisor communication and timely departure norms alongside driver focused content. Third, the impulsivity pattern provides a rationale for testing brief response delay and broader self regulation oriented content. None was tested in the present study, and trait based screening would exceed the evidence.

These proposals concern group level programme content, not employee classification. An employer, transport authority, or insurer could not use these estimates to identify an unsafe individual or infer fitness to drive. A defensible evaluation would randomise or phase in a specified component, record exposure and uptake, and assess behavioural or naturalistic outcomes independently of the predictor questionnaire.

Transport planning and employer mobility management also need exposure denominators. Future evaluations should record how many journeys occurred, their duration and distance, whether the journey followed a work shift, and the traffic and road setting. Such information would allow researchers to distinguish a change in reporting style from a change in behaviour per trip and to test whether programme effects differ by route or schedule. It would also create a clearer bridge between occupational practice, driver education, and the Safe System principle that safety should not rest on one actor alone.

Strengths and Limitations

Strengths include raw item reconstruction, explicit total and conditional models, a covariate choice based on construct rather than significance, HC3 inference, predefined multiplicity families, 10,000 resample intervals, native SPSS reproduction, formal coefficient equality contrasts, and an independent 46 item numerical audit. Null results were retained, and no case was removed because an influence statistic was large.

The cross sectional self report design cannot establish temporal order, causal mechanisms, objective driving risk, or educational effectiveness. Common method covariance, recall, and response consistency can alter associations; no single post hoc diagnostic removes that concern (Podsakoff et al., 2024). Longitudinal or experience sampling work could measure work events before journeys, while naturalistic driving, message timestamps, and crash or near crash records could separate reports from behaviour.

Recruitment was organisation assisted in one Chinese province and does not support representativeness for Shandong, China, or European commuters. The case level log needed to reconstruct the reduction from 668 response identifiers to 492 records was unavailable. The outcomes describe general road behaviour rather than verified commuting events, and commuting frequency and distance contained high values. Future sampling should retain a complete flow log and link exposure windows to specific journeys.

Measurement remains sample specific. The outcomes are not the complete Driver Behaviour Questionnaire; principal component analysis and regression used the same sample; and the exploratory moderator joins two content pairs. One inherited deletion discrepancy and one wording discrepancy remain in the measurement lineage. Independent

translation and measurement validation are needed. Significant specification and White tests also leave functional form or omitted variables plausible despite stable directions in quadratic, Huber, and median regressions. Replication should preregister the primary functional form, preserve null outcomes, and evaluate whether floor concentration requires a bounded or count based model. Educational components were not evaluated and require controlled prospective study.

Conclusion

Among employee car commuters in this archive, Conformity Based Overtime Pressure was associated with Driving Distraction, whereas the impulsivity association with distraction was unclear. Impulsivity was positively associated with Errors and Violations, Lapses, and Aggressive Violations. Overtime pressure showed clearer statistical support for Errors and Violations and Lapses than for Aggressive Violations. Cross sectional coefficient products through distraction were above zero for overtime pressure but included zero for impulsivity. Formal standardised coefficient contrasts did not establish systematic predictor magnitude differences after Holm adjustment. These observed patterns provide a rationale for prospectively evaluating road safety education that protects single task attention and self regulation alongside workplace practices that reduce conformity pressure during the transition from work to driving. The study does not establish a causal mechanism, objective driving risk, or educational effectiveness. European replication should link workday events to specific journeys and combine validated self report measures with behavioural or naturalistic evidence.

Abbreviations

CI
confidence interval
HC3
heteroscedasticity consistent covariance estimator 3
KMO
Kaiser–Meyer–Olkin
OLS
ordinary least squares
PCA
principal component analysis
SPSS
Statistical Package for the Social Sciences
STROBE
Strengthening the Reporting of Observational Studies in Epidemiology
VIF
variance inflation factor.

Declarations

Author Contribution

S.S.: Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing – original draft. J.W.: Supervision; Validation; Writing – review and editing; Project administration. Both authors reviewed and approved the final manuscript.

Data Availability

The raw individual level survey data are not publicly available because the retained project records do not establish permission for public release. Derived analysis outputs and syntax may be made available by the corresponding author on reasonable request, subject to institutional approval and applicable data protection requirements.

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