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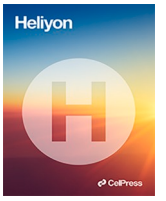

Research article

Chinese adaptation of the reckless driving behaviour scale: Testing its psychometric properties and links with safe driving climate among family and peers

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ABSTRACT

Purpose: The present study aimed to revise the Reckless Driving Behaviour Scale (RDBS) and examined its reliability and validity among young Chinese drivers.
Methods: The RDBS, the Safe Driving Climate among Friends Scale (SDCaF), the Family Climate for Road Safety Scale (FCRSS) and a social desirability scale were administrated to 560 young drivers. Exploratory factor analysis (EFA, $n = 250$) and confirmatory factor analysis (CFA, $n = 250$) were conducted to examine the factorial structure of the RDBS.
Results: The Chinese version of the RDBS has 18 items that are divided into 4 factors: distraction, substance use, extreme behaviour and positioning. Both the results of EFA and CFA confirmed its factorial structure. The reliability of the RDBS was acceptable and the concurrent validity of the scale was supported by its significant associations with the SDCaF and FCRSS factors. Finally, drivers who had violation involvement scored higher on all four factors than their peers who did not have violation involvement, providing evidence for its known-group validity.
Conclusion: The revised RDBS has similar structure with the original version and its reliability and validity were satisfactory. It is an effective tool to measure the reckless driving behaviour of young drivers in China and interventions that incorporated joint efforts of family and peers should be developed.

1. Introduction

In 2016, young drivers (18–25 years of age) accounted for 14.07 % of all traffic deaths, causing 34, 206 injuries and 8048 deaths in China [1]. Reckless driving is one of the main causes of road fatality for young drivers around the world [2]. Although many studies have explored the risky or reckless driving behaviours of young drivers and its related influencing factors [3,4], the effects of parental and peer influences on reckless driving behaviours have rarely been investigated in China.

1.1. Reckless driving

Reckless driving behaviours refer to driving behaviours that lack mainstream social approval, carry strong connotations of negative

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consequences by placing drivers and/or their passengers at risk of mortality and other negative outcomes, and involve deliberate deviations from safe driving habits [5]. Typically, reckless driving includes speeding, ignoring traffic lights, close car following distance, distracted driving and driving while intoxicated [5–7]. Many instruments have been developed to assess reckless driving behaviours, such as the Driver Behaviour Questionnaire (DBQ) [8], Dura Dangerous Driving Index (DDDI) [9], Reckless Driving Habits Scale (RDHS) [7], Behaviour of Young Novice Drivers scale (BYNDS) [10] and the Youth Domains of Risky Driving scale [11].

The QBQ, developed by Reason [8], distinguishes between driving errors and violations, where the former are unintentional behaviours(e.g., distraction, attention-related errors) and the latter are deliberate behaviours (e.g., engaging in speeding or racing). The DDDI, developed by Dula and Ballard [9], contains 28 items that are divided into negative cognitive/emotional driving, aggressive and risky driving. Studies have found that offender drivers who scored higher on risky driving have more extensive records of speeding, ignoring traffic signs and signals than nonoffender drivers [9,12]. The single dimensional RDHS, developed by Taubman-Ben-Ari et al. [7], contains 14 typical reckless driving behaviours (e.g., driving through a red light). The BYNDS, developed by Scott-Parker et al. [10], contains 44 items that are divided into transient violations, fixed violations, misjudgement, risky exposures and driver moods. Studies have shown that risky driving exposure can predict young drivers' self-reported crash involvement [11,13].

Existing instruments are limited in their ability to measure reckless driving behaviours because they either do not include items that represent the diversity of reckless driving behaviours, measure mixed constructs rather than focus solely on reckless behaviour, or are divided into factors or categories that overlap and are not independent [5]. In this regard, Reckless Driving Behaviour Scale (RDBS) was developed by McNally and Bradley [5]. The 21-item RDBS has four factors: distraction, substance use, extreme behaviour and positioning. Distraction refers to behaviour that increases the crash risk due to distractions or deficits in perception, attention or reaction time (e.g., *answer mobile phone while driving*). Substance use refers to behaviour that increases the crash risk due to driving under the influence of drugs or alcohol (e.g., *driving under the influence of drugs*). Extreme refers to actions that increase the crash risk by placing the vehicle in an unsafe environment beyond its design expectations (e.g., *race or chase cars down the road with friends or people that the driver knows*). Positioning refers to actions that increase crash risk due to the vehicle's speed or position relative to other road users (e.g., *change lanes frequently on multi-lane roads*). The RDBS has acceptable reliability in the Australian sample. To the best of knowledge, the RDBS has not been validated in other languages and traffic cultures, such as China.

1.2. Parental and peer influence on reckless driving

Among the factors that influencing reckless driving, family climate [14–16] and peer influence [2,4,17] have been widely explored.

The main body of literature has emphasized the influence of parents' behaviours and parent–child relationship quality on young drivers' risky driving behaviours [15,16]. Consistent findings have shown that a lack of parental commitment to road safety leads to an increase in risky behaviours among young drivers [15,18]. However, some aspects of family climate (e.g., parenting modelling, monitoring and positive feedback) can also serve as protective factors in reducing reckless driving. Taubman-Ben-Ari and Katz-Ben-Ami [16] found that parents' commitment to safe driving and clear message setting on safe driving would reduce young drivers' reckless behaviour. Positive communication and consensus between parents and offspring on safe driving is positively correlated with young drivers' attitudes towards safe driving [19].

On the other hand, the influence of friends is also one of the main causes of reckless driving behaviour in young drivers and is exacerbated by the actual presence of peers in the car [20]. When friends are in the car, they can have a positive or negative influence on the behaviour of young drivers through their own behaviour or safety attitude [2,21]. Previous studies have found that driving with female passengers may affect the ability of young male drivers to handle complex situations, leading to an increased frequency of risky driving behaviours or traffic crashes [2]. Feedback from friends to young drivers expressing appreciation for risky behaviour (e.g., viewing risky driving as acceptable behaviour) may encourage behaviours such as speeding and ignoring traffic rules [22]. Although most studies suggest that driving with friends is riskier, there are some studies that suggest that the socialization process at this age may also contain positive elements [23,24]. For example, Zhang et al. [21] found that the mean proportion of time a young driver had elevated g-force events in curves was significantly lower if they had a close friendship with passengers. Recently, Yang et al. [25] explored peer influence on young drivers' aggressive and prosocial driving behaviours, and found that young drivers who openly talk about driving issues with their friends and support responsible driving tended to have more prosocial behaviours.

1.3. Reckless driving, demographic variables and traffic violations

Demographic factors (e.g., sex and age) also affect the reckless driving behaviours of young drivers. Previous studies have shown that young males exhibit more reckless driving behaviours than female drivers [15,26]. Regarding RDBS factors, sex-related differences were found in positioning, extreme behaviours, and substance use but not in distraction [5]. With respect to age, young drivers are more likely to habitually drive recklessly than older drivers [7,27,28].

Regarding the relationships between reckless driving behaviours and traffic accidents or violations, studies have shown that young drivers' reckless driving behaviours, such as speeding, driving under the influence and distracted driving caused by cell phone use, are closely related to their crash risk [6,29,30].

1.4. Objective of the present study

The main objective is to translate and adapt the RDBS to Chinese by examining its factorial structure through exploratory and confirmatory factor analysis. The concurrent validity of the scale was examined by assessing the links between the RDBS factors and

safe driving climate among families and peers. The known-group validity of the scale was examined by assessing its associations with traffic violation history. It was predicted that a) higher perceptions of the family's noncommitment to safety will be positively associated with higher levels of reckless driving behaviours, as indicated by the relevant factors of the RDBS. Conversely, higher perceptions of a positive climate (e.g., higher communication, clear messages and parental modelling) will be negatively associated with lower levels of reckless driving behaviours; b) higher perceptions of friends pressure and social cost will be positively associated with higher levels of reckless driving behaviours, while higher perceptions of shared commitment to safe driving and communication among friends will be negatively associated with higher levels of reckless driving behaviours; and c) drivers with violations will score higher on the RBDS factors than drivers without violations.

2. Methods

2.1. Participants

Five hundred and sixty young drivers were recruited from three Chinese cities (Chengdu, Wuhan and Dalian). The inclusion criteria are a) holding a valid driving licence and b) at least 18 years old but no more than 25 years old [4,25]. Five hundred and twenty drivers agreed to participate in the study upon knowing the purpose of the study. We ultimately collected five hundred valid data because twenty data were discarded due to missing answers.

The total sample included 245 men (49.0 %) and 255 women (51 %). The drivers ranged in age from 18 to 25 years old ($M = 21.34$, $SD = 2.0$) and had been driving for 3 months to 3 years. A total of 6 % of the participants had a primary school education, 76.4 % had a secondary education and 17.6 % had a university education. Regarding the frequency of driving, 53.6 % of the participants reported driving every day, 23 % reported driving 4–6 days a week, 12.6 % reported driving 1–3 days a week, and 10.8 % said driving once every two weeks. A total of 196 drivers (39.2 %) reported owning a car. A total of 116 drivers (23.2 %) reported a traffic violation in the past 12 months, 384 (76.8 %) reported no traffic violations, 58 (11.6 %) reported having had a traffic crash in the past 12 months, and 442 (88.4 %) reported no traffic crashes.

2.2. Measures

2.2.1. Reckless Driving Behaviour Scale (RDBS)

The original 19-item RDBS, developed by McNally and Bradley [5], contains 4 factors. Participants were asked to rate each item on a 5-point Likert scale, ranging from 1 (never) to 5 (often).

2.2.2. Safe Driving Climate among Friends (SDCaF)

The SDCaF was developed by Guggenheim and Taubman-Ben-Ari [17] in Israel and translated into Chinese in 2021 [4]. The SDCaFS contains 19 items, which are divided into four factors, namely, friend pressure, social cost, communication and shared commitment to safe driving. Friend pressure refers to the driver's perception that their friends are pushing them to drive recklessly. Social costs relate to the driver's feelings of being uncomfortable or even scared while driving with friends. Communication refers to the open discourse among friends on driving issues. Shared commitment to safe driving reflects the collective responsibility for road safety. Participants were asked to rate items on a 5-point Likert scale ranging from 1 (never) to 5 (always). In this study, the internal consistency coefficients (Cronbach's alpha) were 0.90 for friend pressure, 0.97 for social cost, 0.79 for communication and 0.90 for commitment to safe driving.

2.2.3. Family Climate for Road Safety Scale (FCRSS)

The FCRSS was developed by Taubman-Ben-Ari and Katz-Ben-Ami [16] and was translated into Chinese in 2019 [31]. The Chinese version of the FCRSS includes 33 items that were divided into 7 factors, namely, modelling, feedback, communication, monitoring, noncommitment, messages and limits. Modelling refers to a positive model provided by parents in safe driving. Feedback refers to parents' ability to encourage their offspring, to give positive feedback and to praise them for safe and considerate driving. Communication refers to open and direct talk between parents and children about driving behaviours. Monitoring refers to parents' monitoring and controlling of young drivers' driving habits. Noncommitment refers to the family's tendency not to invest time in safety education and to ignore young drivers' risky driving. Message refers to parents delivering clear messages to their young drivers, and limits refer to parents' restrictions on their children's unsafe driving behaviour. Participants were asked to rate each item on a 5-point Likert scale ranging from 1 (never) to 5 (always). In this study, the internal consistency coefficients (Cronbach's alpha) were 0.90 for modelling, 0.82 for messages, 0.92 for feedback, 0.90 for communication, 0.85 for monitoring, 0.87 for limits, and 0.68 for noncommitment.

2.2.4. Social desirability scale

Given that some participants may not truthfully report their reckless driving behaviour, this study also examined social desirability when distributing the scales to control for its potential impact. A 9-item scale extracted from the Traffic Locus of Control Scale was used in this study [32,33]. The items (e.g., I have never broken the traffic rules) were used to assess desirable responses for impression management. Participants were asked to rate each item on a 5-point Likert scale ranging from 1 (not at all possible) to 5 (very possible). The total score was calculated by averaging the 9 items, with higher scores indicating higher levels of social desirability. In this study, the internal reliability (Cronbach's alpha) of the scale was 0.90.

2.2.5. Demographic questionnaire

Demographic information included sex, age, education level and driving frequency. Participants were also asked to indicate how often they had engaged in traffic offenses (e.g., speeding) and at-fault crashes. At-fault crashes refers to a driver having been involved in a crash caused by the driver rather than other road users and the crash resulted in property damage or personal injury while driving in the previous 12 months.

2.3. Procedure

The translation of the scale followed the translation/back-translation procedure. One bilingual researcher translated the original items into Chinese. Another researcher with knowledge of traffic psychology was asked to translate the Chinese version into English. Both versions of the scale in terms of adequacy and clearness of the items were then evaluated by one safety expert in traffic psychology and one policeman. The better version of each item was preserved. Then, a small group of 30 young drivers was consulted and they suggested the need for changes. Hence, the wordings of two items were reworded for better reader comprehension. For example, the wording of one original item (*Text on your phone, search for numbers or search for songs on your MP3 player*) was modified as *Text on your phone, search for songs on your phone.* Finally, an initial scale with 19 items was obtained.

A convenience sample was used in this study. The data were collected between August 1 and 15, 2022, at Walmart and Sam's in three cities. Participants were asked to complete the paper-and-pencil survey anonymously within 30 min. The survey included a demographic questionnaire, the RDBS, the SDCaF, and the FCRSS and a social desirability scale. Each participant received 5 Yuan RMB after completing the questionnaires.

2.4. Data analysis

Data were analysed using SPSS18.0. First, the participants were randomly divided into two samples, and each sample contained 250 drivers. The detailed information for each sample is shown in Supplementary material. Second, descriptive statistical analysis, such as the means, kurtosis and skewness of each item, was calculated using data from sample 1. Third, exploratory factor analysis and reliability analysis were conducted using data from sample 1. In accordance with the recommendations of Ledesma et al. [34], EFA was performed using principal axis analysis with oblique rotation. An oblique rotation method was used since the correlations among components reached and exceeded 0.30. Factor loadings higher than 0.40 were used as item selection criterion. The number of factors were decided when the value of eigenvalues is greater than 1 and by observation of the scree plot. The maximum likelihood estimation method was used for confirmatory factor analysis, and the model fit of RDBS was tested by AMOS 24.0 using data from sample 2. The cut-off value was set at 0.90 for CFI and TLI, 0.08 for approximate root mean square error (*RMSEA),* and an X^2/df value less than 5 [35]. Fourth, multivariate analyses of covariance (MANCOVAs) were conducted to analyze the differences in the factor scores by demographic variables and violation history. Univariate ANOVAs were conducted for sex, education and driving frequency and a

Table 1
Results of exploratory factor analysis.

Item	Factors				M	SD	Skewness	Kurtosis
	Positioning	Distraction	Extreme	Substance use				
1. Will accelerate at too high a speed from a stationary position (e.g. a red light)	**0.75**	0.01	0.04	0.01	1.32	0.67	2.06	3.47
2.I will follow another car at an unsafe distance	**0.75**	−0.05	−0.04	0.03	1.30	0.63	2.28	5.15
3. I will exceed the reduced speed limit by at least 15 km/h in a road work zone	**0.67**	0.04	−0.06	−0.02	1.57	0.94	1.68	2.20
4. Change lanes frequently on multi-lane roads	**0.64**	0.14	−0.03	0.02	1.34	0.68	2.22	4.67
5. I will be driving 15 km/h above the speed	**0.59**	0.12	−0.06	0.02	1.52	1.00	2.17	4.23
6. Turn, merge, or change lanes without instructions limit	**0.58**	−0.02	−0.14	0.15	1.36	0.68	1.92	3.23
7. Eat while driving	0.04	**0.79**	−0.03	−0.03	1.63	0.82	1.49	2.69
8. Text on your phone, search for numbers or search for songs on your phone	0.01	**0.75**	0.01	0.06	1.81	0.99	1.05	0.21
9. Listen to music on your phone while driving or manually search for radio stations on car radio	0.12	**0.71**	−0.03	−0.05	1.88	1.09	1.20	0.74
10. Answer your mobile phone while driving	0.11	**0.69**	0.10	−0.02	1.62	0.80	1.27	1.58
11. I am affected by extreme emotions (e.g. anger)	−0.06	**0.62**	−0.12	0.07	1.70	0.93	1.22	0.92
12 Drive when you are extremely tired or exhausted	−0.13	**0.50**	−0.24	0.22	1.59	0.85	1.44	1.74
13. I race or chase cars down the road with people I don't know	−0.02	0.13	**−0.83**	0.03	1.42	0.80	1.98	3.58
14. Showing languor or "shaking your head"	0.05	−0.01	**−0.82**	−0.05	1.45	0.85	1.96	3.34
15. I race or chase cars down the road with friends or people I know	0.14	0.03	**−0.73**	−0.01	1.43	0.83	2.11	4.32
16. Driving on unsafe roads (if flooded)	0.18	−0.03	**−0.57**	0.08	1.46	0.77	1.71	2.54
17. Suspected of driving with a blood alcohol level above 0.05 (driving while intoxicated)	0.06	0.12	0.14	**0.69**	1.36	0.79	2.26	4.74
18.Driving under the influence of drugs	0.06	−0.06	−0.11	**0.67**	1.70	0.91	1.02	0.21

Pearson correlation for age was performed. Then, the correlations between the RDBS factors, social desirability, the SDCaF, and the FCRSS factors were examined to assess its concurrent validity. Finally, independent sample t tests were conducted to compare the differences in the RDBS factor by traffic violation to assess its known-group validity.

3. Results

3.1. Psychometric properties

The means, standard deviation, skewness and kurtosis of the 19 items were analysed (see Table 1). Combined with the criteria proposed by Kline [36], the present study assumed that the items were normally distributed when the skewness was less than 3 and the kurtosis was less than 7. In this study, the skewness of 19 items ranged from 1.02 to 2.28, and the kurtosis was between 0.21 and 5.15; thus, these items were kept for the following analyses.

3.2. Exploratory factor analysis

The results of the first EFA (extraction: principal axis; rotation: oblimin) with the original 19 items revealed 4 factors that explained 65.59 % of the variance ($KMO = 0.931$, $Bartlett\ Test = 2514.39$, $p < 0.001$). One item with similar loading values in two dimensions was deleted. The remaining 18 items were submitted to a second EFA. The results showed that 4 factors explained 57.51 % of the variance ($KMO = 0.927$, $Bartlett\ Test = 2391.19$, $p < 0.001$). These four factors were positioning, distraction, extreme behaviour and substance use, which explained 42.04 %, 8.07 %, 4.27 %, and 3.13 % of the variance, respectively. The first factor contained 6 items and was labelled positioning. The second factor contained 6 items and was labelled distraction. The third factor contained 4 items and was labelled extreme behaviours. The fourth factor contained 2 items and was labelled substance use. Descriptive statistics of each item and factor load are shown in Table 1.

3.3. Confirmatory factor analysis

The results of CFA show that all indices of model fit are acceptable ($X^2 = 275.86$, $df = 129$, $X^2/df = 2.14$, $p < 0.001$, $CFI = 0.95$, $TLI = 0.94$, $RMSEA = 0.068$, see model 1 in Table 2). The path diagram is shown in Fig. 1.

A bifactor model analysis (with one general factor) was conducted to determine whether a general factor of reckless driving could be obtained. However, the results were not acceptable (see model 2 in Table 2). Another higher-order CFA (with one general factor and four subfactors) was also conducted. The results indicated that the higher-order model did not fit better than the four-factor model, though the value of CFI and TLI are greater than 0.90 (see model 3 in Table 2). The standardized parameter estimates of the higher-order CFA were 0.681, 0.658, 0.862 and 0.939 for distraction, substance use, extreme behaviour and positioning, respectively.

3.4. Reliability of the RDBS

The reliability of the RDBS factors was calculated and indexed using internal consistency coefficients (Cronbach's alpha). The results are shown in Table 3.

Table 3 shows that the internal consistency coefficients of the four factors range from 0.65 to 0.88. The results were comparable to those of the original factors.

3.5. RDBS and demographic factors

The results of MANCOVA reveal a significant effect for sex, $F(4, 242) = 2.65$, $p = 0.034$, and age, $F(4, 242) = 3.58$, $p = 0.007$. The effects of education, $F(4, 242) = 1.81$, $p = 0.127$, and driving frequency, $F(4, 242) = 0.43$, $p = 0.79$, are not significant. Univariate ANOVAs were conducted to examine the differences in the RDBS factors by sex. The means and standard deviations of men and women in the RDBS factors are shown in Table 4.

Univariate ANOVA showed that men scored higher than women in all four factors. The correlations between age and distraction, $r = 0.22$, $p < 0.01$, substance use, $r = 0.12$, $p < 0.05$, positioning, $r = 0.22$, $p < 0.01$ and extreme behaviours, $r = 0.14$, $p < 0.05$, were significant. No significant correlations between the RDBS factors and driving frequency and education level were found.

Univariate ANOVA also showed that the drivers who owned a car scored higher on distraction, $F(1, 248) = 17.34$, $p < 0.05$, substance use, $F(1, 248) = 14.61$, $p < 0.05$, extreme behaviours, $F(1, 248) = 18.22$, $p < 0.05$, and positioning, $F(1, 248) = 24.73$, $p <$

Table 2
Goodness-of-fit indices for three models of the RDBS.

Model	X^2	df	X^2/df	p	CFI	TLI	RMSEA
Model 1	275.86	129	2.14	<0.001	0.95	0.94	0.068
Model 2	741.58	135	5.49	<0.001	0.78	0.75	0.134
Model 3	315.51	131	2.41	<0.001	0.92	0.93	0.075

Note: Model 1 included four factors, model 2 included one general factor and model 3 included one general factor and four subfactors.

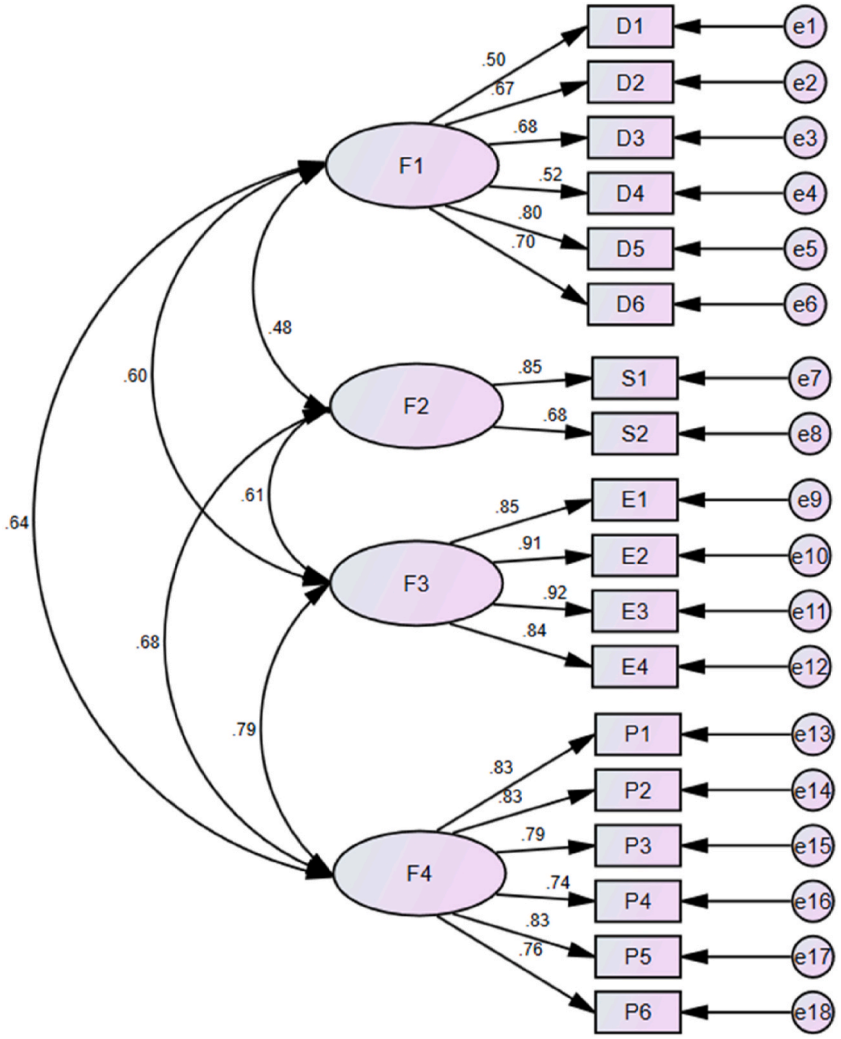

Fig. 1. Path diagram of CFA.
Note: F1 = distraction; F2 = substance use; F3 = extreme behaviour; F4 = positioning.

Table 3
Reliability analysis of the RDBS factors.

RDBS factors	*M*	*SD*	Skewness	Kurtosis	Number of items	Cronbach's alpha	Original reliability[a]
Positioning	1.41	0.62	1.66	2.23	6	0.86	0.81
Distraction	1.70	0.71	1.13	1.34	6	0.86	0.84
Extreme behaviour	1.44	0.70	2.18	5.13	4	0.88	0.82
Substance use	1.53	0.73	1.56	2.57	2	0.67	0.70

Note.
[a] reliability of the original RDBS factors.

0.05, than those who did not own a car.

3.6. Concurrent validity

The correlations between the RDBS factors, the SDCaF, and the FCRSS factors are calculated to examine its concurrent validity; the results are shown in Table 5.

Table 5 shows that the RDBS factors were positively correlated with friend pressure, social cost and noncommitment and negatively correlated with communication, shared commitment to driving, feedback, modelling, messages and limits.

Table 4
Differences in the RDBS factors by sex.

Variables	Sex	*M*	*SD*	*F*(1, 248)	η^2
Distraction	Man	1.88	0.79	14.14**	0.054
	Woman	1.55	0.59		
Substance use	Man	1.63	0.82	5.09**	0.020
	Woman	1.42	0.62		
Extreme behaviour	Man	1.57	0.80	8.98**	0.035
	Woman	1.31	0.56		
Positioning	Man	1.54	0.69	11.63**	0.045
	Woman	1.28	0.50		

Note: *$p < 0.05$, **$p < 0.01$.

3.7. Known-group validity

Spearman correlations show that the RDBS factors were positively correlated with the number of violations, $r = 0.18$, 0.28, 0.31 and 0.32, $ps < 0.01$, for substance use, extreme behaviour, positioning and distraction, respectively. A similar pattern was also found for the number of crashes, $r = 0.13$, 0.17, 0.27 and 0.24, $ps < 0.05$, for substance use, extreme behaviour, positioning and distraction, respectively.

The results of MANCOVA reveal a significant effect for traffic violation, $F(4, 245) = 9.30$, $p = 0.001$ and for traffic crash, $F(4, 245) = 5.63$, $p = 0.001$. Next, the differences in the RDBS factors by traffic violations were analysed to assess its known-group validity. The means and standard deviations of drivers with and without violations/crashes in the RDBS factors are shown in Table 6.

Independent sample *t*-test results showed that drivers with traffic violations scored higher on all four factors than those without traffic violations, distraction ($t = -6.70$, $p < 0.01$), substance use ($t = -3.42$, $p < 0.01$), extreme behaviour ($t = -4.86$, $p < 0.01$) and positioning ($t = -6.02$, $p < 0.01$). Similarly, independent sample *t*-test results show that drivers with traffic crashes scored higher in the four factors than those without traffic crashes, distraction ($t = -6.40$, $p < 0.01$), substance use ($t = -3.96$, $p < 0.01$), extreme behaviour ($t = -5.57$, $p < 0.01$) and positioning ($t = -7.50$, $p < 0.01$). The results show that the discriminative validity of the scale is satisfactory.

4. Discussion

This study translated and adapted the Reckless Driving Behaviour Scale into Chinese and found that its reliability and validity were satisfactory. The validity was examined by assessing its associations with demographic factors, safe driving climate among friends, and family climate for road safety as well as previous violation history.

The final Chinese version of the RDBS has 18 items, which were divided into four factors: positioning, distraction, extreme behaviour and substance use. One item in the original scale was removed during exploratory factor analysis, and the factorial structure of the RDBS was confirmed by confirmatory factor analysis. The reliability of the RDBS factors, ranging from 0.67 to 0.88, was acceptable.

Regarding demographic variables, consistent with the findings of previous studies [5,7], this study found that men scored higher on the four RDBS factors than women. However, McNally and Bradley [5] did not find sex-related differences in distraction. Contrary to previous research findings [27,28], this study revealed that as age increased, young drivers scored higher on the four reckless driving behaviours. Cross-cultural comparisons are needed to explore the possible reasons for these results. Our results indicated that drivers owning a car scored higher on all four factors of the RDBS. It is possible that own a car increased their chance of driving, hence they might report more reckless driving behaviours than those who did not own a car.

The significant associations between the RDBS factors and the SDCaF and the FCRSS factors provided evidence of its concurrent validity. This study found that only FCRSS factors, such as noncommitment, messaging and monitoring, could predict distraction behaviours. The results suggested that young drivers could engage in fewer distraction behaviours if their parents deliver clear safety rules and control their risky driving behaviours in daily driving [15,16]. The results were supported by the findings of prior studies in which they found that noncommitment was a reliable predictor of risky driving behaviours [16,18]. Studies have also demonstrated that young drivers who scored higher on friend pressure and lower on shared commitments to safe driving tended to have more dangerous driving behaviours (such as speeding and rule violations) and crash involvement [4,25,37].

Finally, this study found that young drivers who had a history of violations scored higher on the four RDBS factors than those who did not have traffic violations, indicating that the known-group validity of the scale was satisfactory. The results were consistent with previous findings showing that drivers' self-reported frequency of reckless driving behaviours can positively predict their involvement in car crashes [6,29,30]. This makes the scale a highly useful tool for the behaviour assessment of young drivers who are prone to traffic crashes.

A social desirability scale was used to better identify honest responses. That is, young drivers might not accurately report their traffic violation history and reckless driving behaviours due to impression management. Our results show that social desirability was positively correlated with substance use and extreme behaviours with the coefficients were relatively small, suggesting that social desirability was not a serious problem in this study. The results were in line with the findings of some previous studies showing that social desirability bias in drivers' self-reports is not as troublesome as one might expect [38,39].

Table 5
Correlations between social desirability, the SDCaF, the FCRSS and RDBS factors.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Distraction(1)	1															
Substance use (2)	0.47**	1														
Extreme behaviour (3)	0.51**	0.34**	1													
Positioning (4)	0.56**	0.44**	0.67**	1												
Modelling (5)	−0.26**	−0.19**	−0.53**	−0.38**	1											
Message (6)	−0.20**	−0.13*	−0.32**	−0.33**	0.88**	1										
Monitoring (7)	−0.30**	−0.11	−0.24**	−0.31**	0.75**	0.72**	1									
Feedback (8)	−0.25**	−0.12*	−0.31**	−0.31**	0.81**	0.79**	0.77**	1								
Communication (9)	−0.24**	−0.11	−0.28**	−0.29**	0.79**	0.79**	0.82**	0.88**	1							
Noncommitment(10)	0.31**	0.18**	0.25**	0.21**	−0.07	−0.08	0.02	0.01	0.02	1						
Limits (11)	−0.24**	−0.14*	−0.31**	−0.31**	0.80**	0.73**	0.76**	0.86**	0.85**	0.02	1					
Shared commitment (12)	−0.33**	−0.25**	−0.47**	−0.35**	0.44**	0.41**	0.33**	0.41**	0.40**	−0.23**	0.44**	1				
Communication (SDCaF) (13)	−0.23**	−0.14*	−0.32**	−0.18**	0.39**	0.39**	0.40**	0.42**	0.44**	−0.23**	0.47**	0.70**	1			
Social costs (14)	0.32**	0.22**	0.48**	0.37**	−0.35**	−0.33**	−0.20**	−0.28**	−0.23**	0.18**	−0.24**	−0.31**	−0.06	1		
Friend pressure(15)	0.33**	0.23**	0.48**	0.41**	−0.40**	−0.37**	−0.25**	−0.34**	−0.31**	0.19**	−0.31**	−0.29**	−0.06	0.89**	1	
Social desirability(16)	−0.05	−0.26**	−0.17**	−0.04	−0.02	−0.07	−0.09	−0.09	−0.05	−0.07	−0.06	0.20**	0.05	−0.10	−0.09	1

Note: *$p < 0.05$, **$p < 0.01$.

Table 6
Differences in the RDBS factors by traffic violations.

RDBS Factors	Traffic violation			Traffic crash		
	Yes ($n = 60$)	No ($n = 190$)	*Cohen's d*	Yes ($n = 28$)	No ($n = 222$)	*Cohen's d*
Distraction	2.20 ± 0.88	1.55 ± 0.58	0.87	2.46 ± 0.97	1.61 ± 0.61	1.04
Substance use	1.81 ± 0.79	1.44 ± 0.69	0.50	2.03 ± 0.90	1.47 ± 0.69	0.70
Extreme behaviour	1.81 ± 0.94	1.33 ± 0.56	0.62	2.10 ± 1.14	1.36 ± 0.58	0.81
Positioning	1.80 ± 0.79	1.29 ± 0.49	0.77	2.16 ± 0.90	1.32 ± 0.50	1.15

Yes = have violations or crash record, No = do not have violations or crash record.

5. Implications

This study has some implications. First, the revised RDBS has acceptable reliability and validity. Given that it is a multidimensional scale, it can better reflect the nature of reckless driving behaviour and can better assess different aspects of reckless driving behaviour in China. Second, this study examined the relationships between reckless driving behaviours and parental and peer influence, providing a theoretical approach to reduce young drivers' reckless driving behaviours. For the FCRSS factors, this study found that young drivers' reckless driving behaviour was positively correlated with noncommitment and positively with positive climate, such as parental modelling and frequent communication. These results hint that parents should spend more time investing in safety education for young drivers in the family and pay more attention to reckless driving behaviours. Another approach is to make accompanied driving a compulsory part in China, during which parents can have more time to talk about safe driving rules and monitor young drivers' reckless driving behaviours [40]. For the SDCaF factors, this study found that a higher level of commitment to safe driving and a lower level of friend pressure are associated with lower level of reckless driving behaviours. According to social learning theory, cultivating a safe driving culture among friends might be of great value in reducing reckless driving behaviours [17,18]. One possible way is to have young drivers and their friends participate jointly in safety promoting interventions or programs that can be situated in the license stage of learning how to drive. Third, the subscale scores can distinguish drivers with or without previous violations, making it possible to incorporate the scale into young driver assessment and testing.

6. Limitations

This study has some limitations. First, a convenience sample was used in this study; thus the results may not be generalized to the entire population of young drivers in China. Future studies with larger samples are needed to further examine its external validity. Second, it should be noted that other relevant psychometric properties were not evaluated in this study, such as convergent validity, discriminant validity and test-retest reliability. Although this study showed that the FCRSS and the SDCaF were significantly associated with reckless driving behaviours, other instruments, such as the DBQ and DDDI, should be used to further assess the validity of the revised RDBS. A follow-up study, for instance, might be needed to further explore whether RDBS factors could predict young drivers' crash risk in a one-year period.

7. Conclusion

This study translated and adapted the multidimensional RDBS into young Chinese drivers and found that its factorial structure was culturally comparative and that its reliability was acceptable. The significant associations between the RDBS factors and the SDCaF and the FCRSS factors supported its concurrent validity. The significant differences in the RDBS factors found between drivers with and without violation involvement support its known-group validity. The present study not only contributes to the literature by revealing that parental and peer influence were factors that affected reckless driving behaviours, but also provides a valid tool in the driver assessment of young drivers who are prone to reckless driving behaviours.

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Ethics declarations

This study was reviewed and approved by the Logistics Department for Civilian Ethics Committee of Liaoning Normal University, with the approval number: LL2023027.

All participants provided informed consent to participate in the study.

Data availability statement

Data can be found in figshare, https://doi.org/10.6084/m9.figshare.25249573.

CRediT authorship contribution statement

Yunong Ma: Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Data curation. **Yuanbo Qiu:** Writing – review & editing, Writing – original draft, Software, Resources, Investigation, Formal analysis, Data curation. **Long Sun:** Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:Long Sun reports financial support was provided by Social Science Foundation of Liaoning Province. Yunong Ma reports financial support was provided by Scientific Research and Training Program of Liaoning Province. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

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