**Appendix A: The semi˗structured focus group interview**

The forty-six items relating to driving anger were initially generated by taking the following steps. In the first step, a comprehensive review of the literature was conducted by using the most relevant international electronic repositories involving PubMed, Scopus, Web of Science and Google Scholar combining the search phrases: “driving anger”, “trait anger”, “psychometric properties”, “aggressive driving”, and “validation”. The search process was limited to articles published in English. Studies were taken into account if they met the following criteria: a) a scale was used to measure the tendency of drivers towards anger while driving; and/or b) the psychometric properties of the DAS were examined; and/or c) the predictive validity of the DAS was tested. According to the previous inclusion criteria and systematic search process, the most relevant citations were included in further analysis. The authors, year of conducting the research, country, type of study, sample characteristics (i.e. size, gender and age) and scale used for measuring anger were the parameters based on which the coding of the selected studies was performed.

In the second step, the deductive approach was used to create an initial item pool. Firstly, the items from the manually examined studies were identified. The initial list included 33 items of the original DAS. The selected items were translated into the Serbian language by the authors of the paper. Afterwards, a professional back translation of the material was conducted by a translator. The differences that occurred in the two translations were observed and explained on the part of the researchers by consulting the translator.

In the third step, the inductive approach was applied in order to develop items specific to the Serbian driving context. In addition, it simultaneously gave us a chance to assess alternative instances of item development and review the terminology in cases where the items were unclear. Therefore, at the University of Novi Sad, seven semi-structured focus group interviews were conducted within each group with 9 course participants who were regular drivers. The interviews were audiotaped and transcribed verbatim. This process resulted in a revised draft instrument with extended items and the rewording of items to be appropriate for the target population.

After the focus group and interview analysis, a panel of traffic safety experts was employed to further refine the data. Their role was to provide advice on the items and themes emerging from the data, reduce the items and provide general feedback on the initial scale. The experts' assessment process led to changes with regard to the questionnaire due to a number of reasons, with some of the items being irrelevant, similar or displaying repetition.

Prior to shaping and structuring the questionnaire, another step had to be taken. Eighty-seven students and staff members from the University of Novi Sad participated in a short study in order to ascertain whether the questions were clear enough and to establish if the format was adequately devised. Once the data from the pilot study had been collected and analyzed, the questionnaire was finalized with respect to its structure. Forty-six items of the adapted DAS were included and the questionnaire was sent to a linguist for further checking of mistakes pertaining to the language itself. The list of the forty-six items of the adapted DAS is presented in Table A1.

Table A1. Items for the adapted Driving Anger Scale

|  |
| --- |
| 1. Someone in front of you does not move off straight away when the light turns green.  |
| 2. Someone is driving too fast for the road conditions.  |
| 3. A pedestrian walks slowly across the middle of the street, slowing you down.  |
| 4. Someone is driving too slowly in the outside lane and holding up traffic. |
| 5. Someone is driving very close to your rear bumper.  |
| 6. Someone is weaving in and out of traffic.  |
| 7. Someone cuts in right in front of you on the motorway.  |
| 8. Someone cuts in and takes the parking spot you have been waiting for.  |
| 9. Someone is driving more slowly than is reasonable for the traffic flow. |
| 10. A slow vehicle on a winding road will not pull over and let people pass.  |
| 11. You see a police car watching traffic from a hidden position.  |
| 12. Someone backs out right in front of you without looking.  |
| 13. Someone runs a red light or stop sign.  |
| 14. Someone coming towards you does not dim their headlights at night.  |
| 15. At night, someone is driving right behind you with bright lights on.  |
| 16. You pass a radar speed trap.  |
| 17. Someone speeds up when you try to overtake them.  |
| 18. Someone is slow while parking and holds up traffic. |
| 19. You are stuck in a traffic jam.  |
| 20. Someone pulls out right in front of you when there is no-one behind you.  |
| 21. Someone makes an obscene gesture towards you about your driving.  |
| 22. You hit a deep pothole that was not marked.  |
| 23. A police car is driving in traffic close to you. |
| 24. Someone beeps at you about your driving.  |
| 25. Someone is driving well above the speed limit.  |
| 26. You are driving behind a truck which has material flapping around in the back.  |
| 27. Someone shouts at you about your driving.  |
| 28. A cyclist is riding in the middle of the lane and slowing down traffic. |
| 29. A police officer pulls you over.  |
| 30. You are driving behind a vehicle that is smoking badly or giving off diesel fumes.  |
| 31. A truck kicks up sand or gravel on the car you are driving.  |
| 32. You are driving behind a large truck and cannot see around it.  |
| 33. You encounter road construction and detours.  |
| 34. A public transportation vehicle is pulling into traffic in front of you. |
| 35. Somebody is flashing their headlights at you to move to the right lane so that they could overtake you.  |
| 36. Someone parked their vehicle illegally on the road. |
| 37. Someone is going straight ahead in the left turning lane at an intersection. |
| 38. Somebody has parked their car at an intersection in the right turning lane.  |
| 39. You have come to a part of the road which is seriously damaged or poorly maintained. |
| 40. Someone is driving in traffic close to you and using a mobile phone. |
| 41. Someone passing other vehicles stopped at a red light by driving in the bus lane. |
| 42. A pedestrian is using a mobile phone and not paying attention while crossing the road. |
| 43. You are at a red light that is taking too long. |
| 44. A pedestrian is illegally running across the road outside of a pedestrian crossing. |
| 45. Taxis are pulling up in front of you to let the passengers get in or out of the vehicle. |
| 46. Someone is turning or changing lanes in front of you without using indication lights. |

**Appendix b: Data analysis**

The data analysis was carried out using IBM® SPSS® and Amos™ 22. The preliminary analysis was performed in order to identify the missing values and outliers in the data, as well as to check the normality and measures of the asymmetry (i.e. skewness and kurtosis). In addition, summary statistics (i.e. frequencies, means, and measures of the dispersion) were used to summarize the participants’ responses which had been coded as categorical or quantitative variables. Next, the Principal Component Analysis (PCA) and Confirmatory Factor Analysis (CFA) were used to examine the factorial structure and psychometric properties of the adapted DAS. Using the random selection method in SPSS, the initial group of 1,020 participants was approximately equally divided between the PCA (n = 511) and the CFA (n = 509).

Before performing the EFA, the anti-image correlation matrix of the adapted DAS items was inspected. The results showed that all the items had lots of correlations above 0.30. On the other hand, the two items (i.e. item 14 “being blinded by the headlights of an oncoming vehicle” and item 15 “being blinded by the headlights of a vehicle from behind”) were correlated too highly (r>0.70), indicating semantic similarity between them (see references [F15] and [F32] in Appendix: Section F). Therefore, item 15 was excluded from further analysis. An initial factor analysis indicated poor loadings for some items. In order to address this and to develop a shorter scale, the items with very low communality (<0.30), multiple loading (>0.32), and factor loading of below 0.40 were dropped out (see references [F15] and [F32] in Appendix: Section F). The factors were considered for retention if they had at least three items with factor loadings of 0.50 or more.

The goodness-of-ﬁt of the the five-factor model obtained from the EFA was assessed by utilizing several indices that were available in the literature. Knowing that the χ2-test has the tendency to display extreme sensitivity in those instances when samples consist of a greater number of participants, the more commonly used cut-off criteria in the scientific community were utilized for the purposes of this study. The guidelines for interpreting RMSEA (Root Mean Square Error of Approximation) have been listed: RMSEA lower than 0.05 implies that the fit is good; RMSEA larger than 0.05 but lower than 0.08 means that it is at a reasonable level; RMSEA greater than 0.10 denotes that it is of poor quality. The SRMR (Standardized Root Mean Square Residual) is recommended to be less than 0.08. The χ2/df ratio needs to be between 2 to 5 to indicate an adequate model fit. The value of the Comparative Fit Index (CFI) that exceeds 0.90 and 0.95 implies that the fit is at an acceptable level and that it is excellent (see references [F15] and [F32] in Appendix: Section F). The maximum likelihood estimation method was utilized due to the fact that it can be applied successfully in a variety of instances.

Furthermore, the configural models were tested for factorial invariance across age groups (younger drivers aged 18 to 44 years and older drivers aged 45 to 70), as well as gender (male and female drivers). Then, the convergent and discriminant validity, which are recognized as two forms of construct validity, were examined.

Convergent validity is expressed as the propensity of items which are indicators of specific construct and which have a large proportion of variance in common (see reference [F15] in Appendix: Section F). In line with Hair et al. (see reference [F15] in Appendix: Section F), convergent validity can be evaluated by using average variance extracted (AVE), which is calculated as the mean variance extracted for the items loading on a construct and is a summary indicator of convergence. For adequate convergent validity, the AVE is suggested to be higher than the minimum threshold of 0.50. Nevertheless, as specified by Haris et al. (see reference [F15] in Appendix: Section F), the value of 0.40 is satisfactory. If the AVE value is less than 0.5, and composite reliability is greater than 0.60, the convergent validity of the construct remains adequate (see reference [F14] in Appendix: Section F).

Discriminant validity is the measure of uniqueness of a particular construct, that is, the degree to which a construct is distinguished from other constructs. Discriminant validity for respective constructs was evaluated using the following criteria: a) the correlation coefficient of the two constructs should be less than 0.85; b) squared correlation estimates between two constructs should be less than the AVE values for each of the pairwise constructs; c) the correlations between two constructs should be less than the square root of the AVE for each construct (see reference [F15] in Appendix: Section F).

Finally, the hierarchical linear and binary logistic regressions were performed to evaluate the predictive power of the adapted DAS subscales. All underlying assumptions in terms of the sample size, independence of error terms normality, linearity, singularity, and homoscedasticity were met. The hierarchical regression model was constructed in two steps, using the forced entry selection method. The gender, age and annual mileage were entered in the first step in order to control the demographic and driving exposure effects, and the driving anger subscales were entered in the second step.

**Appendix c: Exploratory factor analysis**

Table A2. Items retained in the augmented Driving Anger Scale after the EFA and the respective factor loadings (n=511)

|  |  |  |  |
| --- | --- | --- | --- |
| Item No. | Items | Rotated factor loadings | Communality |
| IB | DB | HG | SD | TO |
| 40 | Someone is driving in traffic close to you and using a mobile phone. | **0.84** | –0.09 | 0.03 | –0.13 | –0.04 | 0.61 |
| 42 | A pedestrian is using a mobile phone and not paying attention while crossing the road. | **0.79** | –0.23 | 0.13 | 0.14 | 0.07 | 0.63 |
| 41 | Someone passing other vehicles stopped at a red light by driving in the bus lane. | **0.72** | 0.17 | –0.04 | 0.04 | –0.09 | 0.64 |
| 36 | Someone parked their vehicle illegally on the road. | **0.64** | 0.08 | –0.05 | 0.04 | –0.03 | 0.46 |
| 44 | A pedestrian is illegally running across the road outside of a pedestrian crossing. | **0.57** | 0.15 | –0.02 | –0.11 | 0.25 | 0.54 |
| 37 | Someone is going straight ahead in the left turning lane at an intersection. | **0.55** | 0.30 | –0.09 | 0.09 | –0.02 | 0.56 |
| 7 | Someone cuts in right in front of you on the motorway.  | 0.05 | **0.86** | –0.12 | –0.10 | –0.03 | 0.63 |
| 12 | Someone backs out right in front of you without looking.  | –0.09 | **0.80** | –0.01 | –0.05 | 0.05 | 0.57 |
| 20 | Someone pulls out right in front of you when there is no-one behind you.  | 0.00 | **0.65** | 0.00 | 0.06 | 0.13 | 0.56 |
| 5 | Someone is driving very close to your rear bumper.  | 0.20 | **0.60** | 0.04 | –0.15 | –0.17 | 0.41 |
| 8 | Someone cuts in and takes the parking spot you have been waiting for.  | –0.11 | **0.55** | 0.22 | 0.21 | –0.10 | 0.49 |
| 31 | A truck kicks up sand or gravel on the car you are driving.  | 0.18 | **0.49** | –0.07 | 0.11 | 0.08 | 0.45 |
| 14 | Someone coming towards you does not dim their headlights at night.  | 0.17 | **0.42** | 0.18 | 0.17 | –0.02 | 0.51 |
| 27 | Someone shouts at you about your driving.  | 0.05 | –0.04 | **0.93** | –0.09 | 0.01 | 0.81 |
| 24 | Someone beeps at you about your driving.  | 0.01 | –0.04 | **0.87** | 0.00 | 0.03 | 0.75 |
| 21 | Someone makes an obscene gesture towards you about your driving.  | –0.04 | 0.05 | **0.85** | 0.02 | –0.06 | 0.72 |
| 1 | Someone in front of you does not move off straight away when the light turns to green.  | –0.02 | –0.08 | –0.04 | **0.84** | –0.08 | 0.57 |
| 4 | Someone is driving too slowly in the outside lane, and holding up traffic. | –0.01 | 0.20 | –0.04 | **0.73** | –0.07 | 0.62 |
| 9 | Someone is driving more slowly than is reasonable for the traffic flow. | 0.02 | 0.00 | 0.00 | **0.73** | 0.04 | 0.56 |
| 3 | A pedestrian walks slowly across the middle of the street, slowing you down.  | 0.06 | –0.18 | 0.02 | **0.58** | 0.26 | 0.48 |
| 33 | You encounter road construction and detours.  | 0.06 | –0.18 | –0.11 | 0.03 | **0.90** | 0.69 |
| 43 | You are at a red light that is taking too long. | –0.07 | –0.01 | 0.04 | 0.15 | **0.70** | 0.60 |
| 32 | You are driving behind a large truck and cannot see around it.  | 0.16 | 0.10 | 0.07 | –0.19 | **0.61** | 0.48 |
| 19 | You are stuck in a traffic jam.  | –0.25 | **0.43** | 0.06 | –0.03 | **0.58** | 0.63 |
|  | Eigenvalues | 7.49 | 2.31 | 1.66 | 1.28 | 1.24 |  |
|  | % of variance | 31.21 | 9.61 | 6.93 | 5.34 | 5.16 |  |
|  | Cronbach’s alpha | 0.83 | 0.82 | 0.85 | 0.72 | 0.73 |  |

*Note:* Factor loadings over 0.40 appear in bold. DB = Discourteous Behavior, IB = Illegal Behavior, SD = Slow Driving, HG = Hostile Gestures, TO = Traffic Obstruction.

**Appendix d: Results of the hierarchical regression analyses**

Table A3. Summary of hierarchical regression analyses: prediction of aggressive and prosocial driving behavior (n=1,020)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   |   | Aggressive driving behavior |   | Prosocial driving behavior |
|   | Predictors | β | t | Standard error | ΔR2 |   | β | t | Standard error | ΔR2 |
| Step1  |  |  |  |  | 0.05 |  |  |  |  | 0.07 |
|  | Gender | –0.15\*\*\* | –4.57 | 0.04 |  |  | 0.11\*\* | 3.38 | 0.05 |  |
|  | Age | –0.09\*\* | –2.86 | 0.00 |  |  | 0.17\*\*\* | 5.74 | 0.00 |  |
|  | Mileage | 0.09\*\* | 2.97 | 0.00 |  |  | –0.14\*\*\* | –4.40 | 0.00 |  |
| Step 2 |  |  |  |  | 0.28 |  |  |  |  | 0.12 |
|  | Gender | –0.11\*\*\* | –4.06 | 0.04 |  |  | 0.10\*\*\* | 3.50 | 0.05 |  |
|  | Age | –0.02 | –0.79 | 0.00 |  |  | 0.12\*\*\* | 4.28 | 0.00 |  |
|  | Mileage | 0.04 | 1.36 | 0.00 |  |  | –0.08\*\* | –2.82 | 0.00 |  |
|  | Illegal behavior | –0.14\*\*\* | –4.41 | 0.02 |  |  | 0.19\*\*\* | 5.41 | 0.03 |  |
|  | Discourteous behavior | –0.06 | –1.43 | 0.03 |  |  | 0.23\*\*\* | 5.47 | 0.04 |  |
|  | Hostile gestures | 0.07\* | 2.22 | 0.02 |  |  | –0.01 | –0.35 | 0.02 |  |
|  | Slow driving | 0.44\*\*\* | 13.25 | 0.03 |  |  | –0.24\*\*\* | –6.75 | 0.04 |  |
|   | Traffic obstruction | 0.20\*\*\* | 6.19 | 0.03 |   |   | –0.19\*\*\* | –5.18 | 0.04 |   |
|   | R2 | 0.33 |   | 0.19 |

**Note:** \*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001

**Appendix e: Results of the binary logistic regression models**

The results of the binary logistic regression models are presented in Table A4. The model significantly improved the prediction of traffic violations χ2(10) = 148.28, p < 0.001, and self-reported accidents χ2(10) = 26.06, p < 0.01, comparing to the baseline model. Moreover, the Nagelkerke’s R Squared indicated that the models explained 18.40% of the variance in traffic violations and 4.50% in road accidents. The findings revealed that male (OR = 2.04) and high-mileage drivers (OR = 1.26) were more likely to commit traffic violations than female and low-mileage drivers. Drivers who tended to drive more aggressively showed OR = 1.36 times greater probability to commit traffic violations. In addition, drivers who showed a greater tendency to be involved in prosocial driving practices were 1.41 times less likely to declare that they engaged in traffic violations during the last twelve months. The drivers’ age and driving anger subscales emerged as insignificant predictors of traffic violations. Drivers who drive more than 5,000 kilometers annually were OR = 1.14 times more likely to be involved in accidents than drivers who drive less than 5,000 kilometers annually. Furthermore, drivers who experienced a higher level of driving anger in situations where the other road users behaved illegally were OR = 1.33 times more likely to be involved in at least one accident. Finally, drivers who were prone to behave prosocially were OR = 1.17 times less likely to report involvement in accidents. Gender, age, discourteous behavior, hostile gestures, slow driving, traffic obstruction, and aggressive driving were not significant predictors of self-reported road accidents.

Table A4. Summary of binary logistic regression models: prediction of self-reported accidents and violations (n=1,020)

|  |  |  |  |
| --- | --- | --- | --- |
| Predictors | Self-reported violations |   | Self-reported accidents |
| B | Standard error | Wald | Odds Ratio |  | B | Standard error | Wald | Odds Ratio |
|   |
| Gender (Male) | –0.71\*\*\* | 0.15 | 21.38 | 0.49 |  | –0.09 | 0.20 | 0.21 | 0.91 |
| Age (Young) | 0.24 | 0.12 | 3.68 | 1.27 |  | –0.33 | 0.17 | 3.79 | 0.72 |
| Annual Mileage (0 – 5.000) | 0.23\*\*\* | 0.05 | 23.35 | 1.26 |  | 0.13\* | 0.06 | 4.38 | 1.14 |
| Illegal behavior | –0.12 | 0.09 | 1.65 | 0.89 |  | 0.29\* | 0.12 | 5.87 | 1.33 |
| Discourteous behavior | 0.00 | 0.13 | 0.00 | 1.00 |  | –0.14 | 0.17 | 0.66 | 0.87 |
| Hostile gestures | –0.07 | 0.08 | 0.73 | 0.94 |  | 0.01 | 0.10 | 0.01 | 1.01 |
| Slow driving | 0.24 | 0.13 | 3.24 | 1.27 |  | 0.11 | 0.16 | 0.44 | 1.12 |
| Traffic obstruction | –0.03 | 0.12 | 0.06 | 0.97 |  | –0.08 | 0.15 | 0.30 | 0.92 |
| Prosocial driving | –0.34\*\*\* | 0.09 | 13.15 | 0.71 |  | –0.23\* | 0.11 | 4.07 | 0.79 |
| Aggressive driving | 0.31\* | 0.13 | 5.70 | 1.36 |  | 0.14 | 0.16 | 0.76 | 1.15 |
| Constant | 0.53 | 0.65 | 0.67 | 1.71 |   | –0.95 | 0.81 | 1.40 | 0.39 |

**Note:** Rvio2=13.50 (Cox & Snell R Square), 18.40 (Nagelkerke R Square); Model χ2(10)=148.28, p< 0.001

Racc2=2.50 (Cox & Snell R Square), 4.50 (Nagelkerke R Square); Model χ2(10)=26.06, p< 0.01

\*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001

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