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Severe nomophobia is a predictor of poor road safety among motorists

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Abstract

Purpose – Using a mobile phone is increasingly becoming recognized as very dangerous while driving. With a smartphone, users feel connected and have access to information. The inability to access smartphone has become a phobia, causing anxiety and fear. The present study's aims are as follows: first, quantify the association between nomophobia and road safety among motorists; second, determine a cut-off value for nomophobia that would identify poor road safety so that interventions can be designed accordingly.

Design/methodology/approach – Participants were surveyed online for nomophobia symptoms and a recent history of traffic contraventions. Nomophobia was measured using the nomophobia questionnaire (NMP-Q).

Findings – A total of 1731 participants responded to the survey; the mean age was 33 ± 12, and 43% were male. Overall, 483 (28%) [26–30%] participants received a recent traffic contravention. Participants with severe nomophobia showed a statistically significant increased risk for poor road safety odds ratios and a corresponding 95% CI of 4.64 [3.35-6.38] and 4.54 [3.28-6.29] in crude and adjusted models, respectively. Receiver operator characteristic (ROC)-based analyses revealed that NMP-Q scores of = 90 would be effective for identifying at risk drivers with sensitivity, specificity and accuracy of 61%, 75% and 72%, respectively.

Originality/value – Nomophobia symptoms are quite common among adults. Severe nomophobia is associated with poor road safety among motorists. Developing screening and intervention programs aimed at reducing nomophobia may improve road safety among motorists.

Keywords Automobile drivers, Illegal smartphone use, Nomophobia, Hazardous phone use, Risky driving

Paper type Research paper

1. Introduction

Over 1.35 million people die in traffic accidents every year (WHO, 2015, 2020). There are an additional 50 million people who sustain non-fatal injuries, many of whom go on to develop disabilities of various severities (WHO, 2015, 2020). Ninety-five percent of those accidents occur in low- and middle-income countries (WHO, 2015, 2020).

Massive efforts were made to promote road safety over the past decade, and many governments have made the issue a top priority in accordance with the UN Sustainable

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Informed consent statement: Informed consent was obtained from all participants involved in the study.

Data availability statement: Datasets analyzed during the current study are available immediately (no questions) upon request from the corresponding author.

Conflicts of interest: The authors declare no conflict of interest.

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Development Goals (SDGs) (EU Commission, 2010; TO & Barker, 2001), which include the target of reducing the number of fatalities and injuries from traffic accidents by half by 2030 (Mwebesa, Yoh, & Doi, 2021).

Traditionally, policy decisions have been based on three main risk factors for road injuries and deaths. These are speeding, intoxicated driving and using safety devices (e.g., motorcycle helmets and seatbelts) (GBD, 2022). Recent research showed that one of the major contributing factors to road accidents is traffic contraventions, which have been proven to be strongly correlated with motorist attitudes toward traffic safety (Tan, Shi, Bai, Tang, Suzuki, & Nakamura, 2022). Traffic contravention data can be considered a marker of a motorist's road safety. These data keep track of any illegal conduct that has resulted in a citation from a law enforcement official (Lund & Rundmo, 2009).

Recent studies show that using a mobile phone while driving increases reaction time (Caird, Simmons, Wiley, Johnston, & Horrey, 2018; Strayer and Johnston, 2001), compromises lateral vehicle control (Caird, Johnston, Willness, Asbridge, & Steel, 2014; Caird *et al.*, 2018; Caird, Willness, Steel, & Scialfa, 2008) and makes maintaining a safe following distances less likely (Caird *et al.*, 2008). Thus, due to the widespread usage of mobile phones and their detrimental impact on traffic safety, several nations have enacted various prohibitions on using them while driving (Lipovac, Đerić, Tešić, Andrić, & Marić, 2017). Nonetheless, a recent study from Saudi Arabia reported that up to 95% of young adults use mobile phones while driving (Almansoor & Jahan, 2021).

The evidence is mounting that driver distraction and driver inattention are the main factors contributing to accidents involving vehicles (Regan, Hallett, & Gordon, 2011). The relationship between them is yet unknown, and they have inconsistent definitions as applied psychological categories (Regan *et al.*, 2011). Regan, Hallett, and Gordon's (2011) Driver Distraction Model is a framework for understanding and classifying the causes of driver distraction (Regan *et al.*, 2011). This model can be used to examine how using a smartphone affects driving distraction (Regan *et al.*, 2011). The model identified four main factors contributing to driver distraction (Regan *et al.*, 2011). Sensory cues are distractions that cause the driver to become aware of their surroundings, such as an incoming call or a smartphone notification sound (Regan *et al.*, 2011). When a driver receives a notice from their smartphone, they might be tempted to check it, which could distract them from the road (Regan *et al.*, 2011). Physical demands are the acts that must be taken in order to interact with a distraction, such as reaching for and using a smartphone (Regan *et al.*, 2011). The danger of an accident rises when a driver's hands are off the wheel and their eyes are off the road when they are holding a smartphone and texting or scrolling through social media feeds (Regan *et al.*, 2011). The mental abilities (i.e., cognition) needed to process the information supplied by a distraction are known as cognitive demands (Regan *et al.*, 2011). On a smartphone, reading a text message or having a conversation diverts a driver's attention from the road and requires cognitive resources (Regan *et al.*, 2011). This may result in slower reflexes and poorer judgment (Regan *et al.*, 2011). Finally, the driver's expectation of a specific incident or dist raction is referred to as expectation (Regan *et al.*, 2011). Drivers may be more prone to become distracted by their smartphones if they are anticipating an important call or message while operating a motor vehicle (Regan *et al.*, 2011).

Thus, using a smartphone while driving can provide a variety of distractions, including cognitive, manual and visual ones. When drivers look away from the road to look at their devices, visual distractions emerge. Drivers' physical interactions with their devices when their hands are off the wheel cause manual distractions. Cognitive distractions occur when motorists mentally interact with their smartphones, taking their focus away from the task of driving. Motorists hold their mobile phones in their hands while driving for a variety of reasons (Jahrami *et al.*, 2021a, b; Kaviani, Robards, Young, & Koppel, 2020; Kaviani, Young, & Koppel, 2022a, b). Some examples are: ordering takeout foods, communicating with family/

colleagues/friends, looking for navigational directions, paying bills and making bookings (e.g., cinema), participating in educational or work-related meetings and checking the news feed are all accessible anywhere and at any time. However, motorists do not always pay attention to the fact that most of the above activities demand full cognitive attention (Jahrami *et al.*, 2021a, b; Mendoza, Pody, Lee, Kim, & McDonough, 2018; Wilmer, Sherman, & Chein, 2017). In simulated lab-based driving situations, both handheld and hands-free mobile phones have been found to cause comparable performance declines (Lipovac *et al.*, 2017). The usage of smartphones while driving has changed from being distracted primarily by calls and texts to being distracted by social media platforms (e.g., TikTok, Twitter, Discord, Facebook, Instagram, Snapchat, YouTube), instant messengers and email (Kaviani, Young, & Koppel, 2022a, b; Rowden & Watson, 2014).

The term nomophobia has been created to describe the phobia/fear of being without a mobile phone (Yildirim, 2014; Yildirim & Correia, 2015). The phrase, which is an acronym for "no mobile phone phobia," describes the discomfort, uneasiness, or worry brought on by being cut off from a cell phone (Jahrami *et al.*, 2023b).

Studies have revealed that nomophobia shares psychological constellations with other psychosocial conditions, behavioral addictions and mental illnesses, further complicating the experience and encouraging perceptions of the condition as a sign of psychopathological conditions and treatable comorbidities (King *et al.*, 2013, 2014; King, Valença, & Nardi, 2010).

A handful of available studies, have recognized the rising problem of smartphone usage while driving for road safety and investigated if nomophobia may forecast a driver's predisposition for unsafe use of the road (Kaviani, Benier, Robards, Young, & Koppel, 2021; Kaviani *et al.*, 2020; Kaviani *et al.*, 2022a, b; Kaviani, Young, Robards, & Koppel, 2020a, b, 2021). The focus was to: First, quantify the association between nomophobia and road safety among motorists. Second, determine a cut-off value for nomophobia that would identify poor road safety so that interventions can be designed accordingly. It is hypothesized that a nomophobia score of 100 or greater (i.e., severe nomophobia) is linked to a higher risk of poor road safety.

2. Materials and methods

2.1 Design and setting of the study

Using a cross-sectional design this study gathered data from adult drivers (18 years of age and older) in Bahrain. Platforms for crowdsourcing like Amazon Mechanical Turk are not often used for research in some nations (like Bahrain). However, social media platforms are widely used to collect volunteers from a diverse set of people using an open call, which is the definition of crowdsourcing. This practice is now known as "social media crowdsourcing", and it has been validated by Paniagua and colleagues (Paniagua and Korzynski, 2017).

In a recent systematic review and meta-analysis of 96 studies, crowdsourcing techniques are practical and efficient for data collection (Wang *et al.*, 2020). The present study imitated a crowdsourcing platform by distributing announcements on Facebook, Twitter, Instagram and diverse instant messaging chat groups (WhatsApp Messenger, Line, Viber, Blackberry Messenger (BBM), Telegram Messenger, IMO and Discord). This allowed us to collect data from a large pool of participants.

Between May and August 2022, participation requests were made for a variety of groups with shared interests, such as studies (e.g., classroom groups), hobbies (e.g., sports, music), small communities (e.g., regional neighborhoods) and microblogging groups. The dedicated data collection universal resource location (i.e., weblink) of each group was shut down after it reached 25–30 participants to guarantee a heterogeneous sample.

People who could be eligible for the survey were invited to send or crowdsource the URL link to their coworkers, colleagues and family members. The survey implemented mandatory fields for all survey variables to prevent missing data. The Checklist for Reporting Results of Internet E-Surveys was used to develop the electronic survey (Eysenbach, 2004). To ensure quality and rigor in research design and documentation, the study adopted the STROBE guidelines, which included 22 items that should be addressed in articles reporting epidemiological findings (von Elm *et al.*, 2014).

2.2 Considerations related to ethics

The 1964 Helsinki Declaration and its revisions were followed throughout the whole study procedure. Bahrain's Secondary Healthcare Research Ethics Committee (REC), with permission code REC/CS/126/2022, reviewed and authorized this study. Participants gave written, informed electronic consent before data collection. Anonymity was ensured during the research by keeping participants' identities completely untraceable. Participation in the study was entirely voluntary, and participants were not paid or compensated in any way.

2.3 Size of the sample and participants in the study

A convenient, self-selected, non-probability sample of people (18 years of age or older, of both sexes), who had at least one mobile device, have been drivers for at least 12 months (with a valid driving license) and were cooperative to take part in the study, was used. A total of 1731 participants provided useable responses to the survey. A total of 483 (28%) [26–30%] participants received one or more traffic contravention during the past four weeks. The mean age for the entire sample was 33 ± 12, about 43% were male, 71% were single and 88% were employed or full-time students.

For powered analyses it was estimated that a sample size of approximately 750 would provide 80% power using an α of 5% and a β of 20%. The assumptions for the sample size/powered analysis calculations included a prevalence: of severe nomophobia is about 20-25% based on a global meta-analysis (Humood *et al.*, 2021), and the point rate of traffic contravention is 25% in any given sample based on local statistics (GDT, 2020).

2.4 Research measures

A brief screening, direct questioning and skip logic algorithms were used to exclude participants with established medical or mental disorder diagnoses. To measure the level of phobia/anxiety that participants felt while they were without their smartphone or mobile device, the nomophobia questionnaire (NMP-Q) was employed (Yildirim, 2014; Yildirim & Correia, 2015). The NMP-Q is made up of 20 questions, each of which is graded on a seven-point Likert-style scale, from 1 ("strongly disagree") to 7 ("strongly agree") (Yildirim, 2014; Yildirim & Correia, 2015). According to the NMP-Q four dimensions of nomophobia are found: not being able to communicate (6 items), losing connectedness (5 items), not being able to access information (4 items) and giving up convenience (5 items). Sample items are: I would be worried because my family and/or friends could not reach me (dimension 1); I would be nervous because I would be disconnected from my online identity (dimension 2); I would be annoyed if I could not look information up on my smartphone when I wanted to do so (dimension 3); and running out of battery in my smartphone would scare me (dimension 4) (Yildirim, 2014; Yildirim & Correia, 2015; Yildirim, Sumuer, Adnan, & Yildirim, 2016).

The lack of nomophobia received a score of 20 or less, whereas mild nomophobia received a score between 21 and 59, moderate nomophobia received a score between 60 and 99, and severe nomophobia received a score between 100 and 140 (Yildirim, 2014; Yildirim & Correia, 2015). In this study, the NMPQ's Arabic version was utilized. With a high-reliability

Cronbach's alpha coefficient of about 0.90 (90%) (Al-Balhan *et al.*, 2018). The participants self-reported their history of traffic violations in the previous four weeks. Traffic violations (of any type, minor or major) endanger lives of the drivers and other road users. Their use as a marker for road safety in the present research is intuitive, logical and evidence-based. Several studies showed that a positive history of traffic violations is a good predictor of poor road safety or risky driving (Bon de Sousa *et al.*, 2016; Evans, 1996; Iversen & Rundmo, 2004; Nabi *et al.*, 2007; Parker, Reason, Manstead, & Stradling, 1995).

2.5 Statistical analyses

The data was displayed before being analyzed to check for normality and identify outliers. The statistical technique used to formally determine whether a continuous variable follows a normal distribution was the Shapiro-Wilk test. Outliers were minimal (16 instances) and were replaced using mean scores.

Cronbach's alpha coefficient (α) (Heo, Kim, & Faith, 2015), McDonald's omega coefficient (ω) (Zhang & Yuan, 2016) and the greatest lower bound (Ten Berge & Sočan, 2004) were used as metrics to measure the internal consistency of the findings about nomophobia scores measured using NMP-Q. Results were reported as metrics and their corresponding 95% confidence intervals. For the three internal consistency metrics, a value of >0.9 was considered excellent; >0.8 was considered good; and >0.7 was considered acceptable (Heo *et al.*, 2015; Zhang & Yuan, 2016). The standardized root mean square residual (SRMR) was used to calculate the validity of a single-factor model (Pavlov, Maydeu-Olivares, & Shi, 2021). A value of zero denotes a perfect fit because the SRMR is an absolute measure of fit. No penalty for model complexity exists in the SRMR. In general, a value of less than 0.08–0.10 was regarded as a good fit (Pavlov *et al.*, 2021).

The samples were described using descriptive statistics, specifically mean, standard deviation, or frequency count and proportion, depending on the data type. Chi-square (χ^2) was used to examine the relationship between two variables in a contingency table (Howell, 2011). It was used to see if the distributions of category variables differed from one another more broadly (Howell, 2011). Cramer's V effect sizes were provided along with the results of χ^2. Cramer's V was classified as follows: small 0.10, medium 0.30 and large 0.50 (Sun, Pan, & Wang, 2010). The independent samples *t*-test was used to analyze the means of two separate groups to see if there was statistical support that the population mean values were statistically significant different from one another (Gerald, 2018). Cohen's d was reported as an effect size along with *t* tests. The effect sizes of Cohen's d were classified as small at 0.25, medium at 0.50 and big at 0.80 (Cohen, 1988). To ascertain whether there were any statistically significant differences between the means of three or more independent groups, the one-way analysis of variance (ANOVA) *F* test was utilized (Tian, Manfei, Justin, Hongyue, & Xiaohui, 2018). Eta-squared (η2) (Richardson, 2011) was reported as an effect size along with *F* tests. The effect sizes of η2 were classified as small 0.01, medium 0.06 and large 0.14 (Richardson, 2011).

Logistic regression analysis (Sperandei, 2014) was used to measure the strength and direction of association with the binary outcome (traffic contraventions), based on prior observations of nomophobia scores. Results of two models (a crude model (Model 1) and an adjusted model (Model 2), adjusting for age, sex and marital status) were reported. Results were produced in terms of odds ratios and a corresponding 95% confidence interval.

The true positive rate (sensitivity) versus the false positive rate (1-specificity) for the various alternative cutoff points of the diagnostic ability of nomophobia scores were used to predict the history of traffic infractions using the receiver operator characteristic (ROC) or area under curve (AUC) (Janssens and Martens, 2020). The ROC test aimed to determine the best cutoff point to be used in predicting unsafe driving (Janssens and Martens, 2020). The highest accuracy percentage and the highest specificity percentage were used to determine the best cut-off value to identify at risk motorists based on the nomophobia score.

Youden's index, Cohen's kappa, F1 score, accuracy and misclassification cost are additional fitness metrics that were used to evaluate the performance of binary classification model of the ROC/AUC. Youden's index is a single metric that combines sensitivity and specificity into a single value, and it can be used to identify the optimal threshold for classifying positive and negative cases. A higher value of Youden's index indicates better performance (Yin, Samawi, & Tian, 2022). Cohen's Kappa is a measure of inter-rater agreement that considers the possibility of agreement occurring by chance. It is particularly useful when evaluating the performance of classifiers on imbalanced datasets (Ying, Maguire, Glynn, & Rosner, 2022). The F1 Score is a weighted harmonic mean of precision and recall, and it provides a single metric that balances both measures. It is useful in scenarios where both false positives and false negatives are equally important (Fourure, Javaid, Posocco, & Tihon, 2021). Accuracy measures the proportion of correctly classified cases among all cases. It is a popular metric but can be misleading in scenarios where the cost of errors is imbalanced (Ying *et al.*, 2022). Finally, misclassification cost is a metric that considers the cost of different types of errors, such as false positives and false negatives (Pietraszek, 2007). It can be used to identify the optimal threshold for classification based on the relative costs of different types of errors (Pietraszek, 2007).

The Stata for Windows, StataCorp Inc., version 17 software package (Stata, 2021) was used to analyze the data. Statistics were deemed significant at $p < 0.05$.

3. Results

Results of nomophobia symptoms measured using the NMP-Q showed high psychometric properties. The result of internal consistency showed that Cronbach's α, McDonald's ω, and the greatest lower bound were 0.93 [0.92-0.94], 0.94 [0.93-0.95] and 0.97 [0.96–9.80], respectively. Internal consistency was high for the four dimensions (i.e., factors) of the NMP-Q. Specifically Cronbach's α was 0.90, 0.91, 0.80 and 0.80 for Factor I – Not being able to communicate, Factor II – Losing Connectedness, Factor III – Not being able to access information and Factor IV – Giving up convenience, respectively. The fit of a single-factor model was measured using SRMR, which showed a value of 0.1, suggesting good validity.

The mean nomophobia score for the entire sample was 80 ± 26. Participants with a positive history of traffic contraventions had a large and statistically significant nomophobia score compared to those with no history of traffic contraventions, 92 ± 27 and 75 ± 25. Table 1 shows the descriptive statistics of the study participants, including the demographic characteristics of the study participants as a whole and a comparison between groups according to road safety status using the history of traffic contravention as an indicator.

Table 2 provides summary statistics of the study participants according to nomophobia status/severity. The prevalence of symptoms of nomophobia was: 1%, 22%, 53% and 25% for no nomophobia, mild nomophobia, moderate nomophobia and severe nomophobia, respectively. For no nomophobia, mild nomophobia, moderate nomophobia and severe nomophobia, the rates of traffic violations were 19%, 18%, 22% and 50%, respectively. The distribution of the 483 traffic violations for no nomophobia, mild nomophobia, moderate nomophobia and severe nomophobia were: 0.8%, 14.5%, 41.8% and 42.9%, respectively.

According to Table 2, the four dimensions of nomophobia symptoms were: "not being able to communicate", "losing connectedness", "not being able to access information" and "giving up convenience" were in positive concordance according to symptom severity.

Table 3 provides the strength and direction of the association between road safety and nomophobia. Using mild nomophobia as a reference, participants with severe nomophobia showed a statistically significant increased risk for poor road safety. The resultant odds ratio and corresponding 95% CI were 4.64 [3.35-6.38] and 4.54 [3.28-6.29] in crude and adjusted

Variable	Total sample n = 1731	No traffic contravention n = 1248	Traffic contravention n = 483	p-value	ES
Sex (Male)	736 (43%)	526 (42%)	210 (44%)	0.6	0.01
Marital status (Single)	1225 (71%)	855 (67%)	370 (77%)	0.01	0.1
Job (Employed or full-time students)	1535 (88%)	1107 (88%)	406 (85%)	0.7	0.1
Age	33 ± 12	33 ± 12	32 ± 12	0.3	0.1
NMPQ Score	80 ± 26	75 ± 25	92 ± 27	<0.001	0.7
Not being able to communicate	25 ± 10	23 ± 9	28 ± 9	<0.001	0.5
Losing connectedness	17 ± 9	16 ± 8	21 ± 9	<0.001	0.6
Not being able to access information	17 ± 6	17 ± 6	19 ± 6	<0.001	0.5
Giving up convenience	20 ± 8	19 ± 8	23 ± 8	<0.001	0.6

Note(s): Results presented as mean ± standard deviation for continuous data or frequency counts and percentage for categorical data; NMP-Q = Nomophobia Questionnaire (NMP-Q); ES = effect size; significant at $p < 0.05$; ES = effect size for categorical variables, Cramer's V effect sizes were provided, and for continuous variables, Cohen's d. Traffic contravention was a behavior that violated traffic regulations throughout the last four weeks
Source(s): Table by authors

Table 1. Descriptive statistics of the study participants

Variable	No nomophobia n = 16 (1%)	Mild nomophobia n = 389 (22%)	Moderate nomophobia n = 913 (53%)	Severe nomophobia n = 413 (24%)	p-value	ES
Sex (Male)	6 (38%)	172 (44%)	387 (42%)	171 (41%)	0.8	0.1
Marital status (Single)	14 (88%)	252 (65%)	647 (71%)	312 (75%)	0.04	0.1
Traffic contraventions	3 (19%)	70 (41%)	202 (22%)	208 (50%)	<0.001	0.3
Age	37 ± 11	35 ± 12	33 ± 12	31 ± 12	<0.001	0.1
NMPQ Score	20 ± 1	45 ± 10	80 ± 11	114 ± 11	<0.001	0.8
Not being able to communicate	6 ± 1	14 ± 5	25 ± 6	36 ± 5	<0.001	0.6
Losing connectedness	5 ± 1	9 ± 4	17 ± 6	27 ± 5	<0.001	0.6
Not being able to access information	4 ± 1	11 ± 4	18 ± 5	23 ± 4	<0.001	0.5
Giving up convenience	5 ± 1	12 ± 5	20 ± 6	28 ± 5	<0.001	0.6

Note(s): Results presented as mean ± standard deviation for continuous data or frequency counts and percentage for categorical data; NMP-Q = Nomophobia Questionnaire (NMP-Q); ES = effect size; significant at $p < 0.05$; ES = effect size for categorical variables, Cramer's V effect sizes were provided, and for continuous variables, eta squared η2. Traffic contravention was a behavior that violated traffic regulations throughout the last four weeks
Source(s): Table by authors

Table 2. Summary statistics of the study participants according to nomophobia status/ severity

models, respectively. The goodness of fit showed that the adjusted model offers better explanatory power.

Table 4 shows the results of a ROC analysis to determine the best score cutoff to identify at risk motorists based on their nomophobia score. Table 4 displays results for NMP-Q scores between 50–120 only and includes sensitivity, specificity and the accuracy of various cutoff points in predicting road safety. Table 4 also shows the ROC fitness metrics included Youden's index, Cohen's Kappa, F1 Score and Misclassification Cost.

The results of the ROC analysis suggest that the best cutoff value was ≥90, which was in the upper limits of moderate nomophobia. NMP-Q scores of ≥90 would be effective for identifying at risk drivers with sensitivity, specificity and accuracy of 61%, 75% and 72%, respectively. An AUC of 0.70 [0.66; 0.71] was computed from the analysis. Figure 1 provides a visual display of the ROC and AUC analysis of the nomophobia score in predicting road safety. The results of ROC and AUC are shown on a five-point incremental scale. The proportions of traffic violations among motorists who scored NMP-Q < 90 were 187 (11%) compared to those who scored NMP-Q ≥ 90 were 296 (17%).

Table 3.
The association between road safety and nomophobia

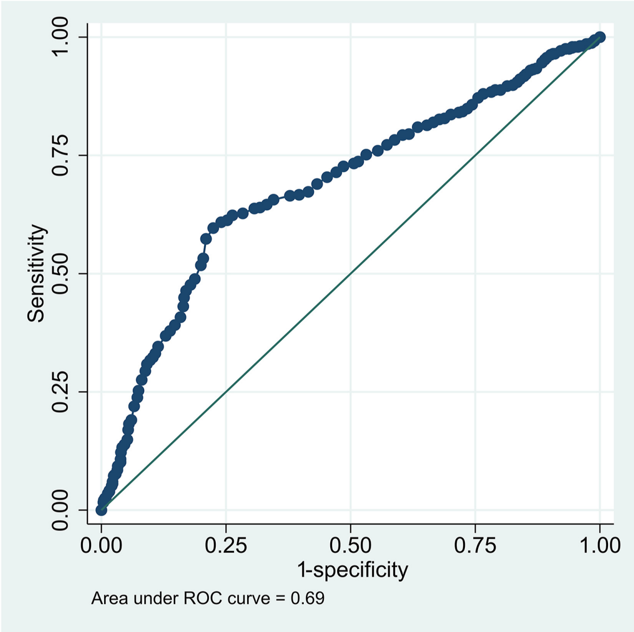
Variable*	Model 1 OR [95%CI]	Model 1 p-value	Model 2 OR [95%CI]	Model 2 p-value
Moderate nomophobia	1.29[0.96-1.75]	0.9	1.59[0.44-5.74]	0.1
Severe nomophobia	4.62[3.35-6.38]	0.01	4.54[3.28-6.29]	0.001

Note(s): Logistic regression analysis. The dependent variable in model 1 and model 2 was road safety measured by an indicator variable of the presence of a traffic contravention history in the past four weeks. The independent variable was nomophobia status (against the reference of no nomophobia). Model 1 was crude, and Model 2 adjusted for age, sex, ad marital status. **Significant at $p < 0.05$. *Ref = mild nomophobia
Source(s): Table by authors

Table 4.
A receiver operating characteristic analysis to determine the best score cutoff to identify motorists at risk for road safety based on nomophobia score

Cutoff	Sensitivity (%)	Specificity (%)	Youden's index	Cohen's kappa	F1 score	Accuracy	Misclassification cost
50	91%	16%	0.07	0.04	0.45	37%	1091
55	89%	21%	0.10	0.06	0.45	40%	1040
60	85%	27%	0.11	0.07	0.45	43%	989
65	83%	32%	0.15	0.10	0.46	46%	930
70	79%	40%	0.19	0.13	0.47	51%	854
75	74%	48%	0.22	0.17	0.48	56%	770
80	69%	57%	0.26	0.21	0.49	60%	690
85	65%	67%	0.31	0.27	0.52	66%	585
90	61%	75%	0.37	0.33	0.54	72%	502
95	52%	80%	0.32	0.31	0.51	72%	482
100	43%	84%	0.27	0.28	0.46	72%	480
105	35%	89%	0.23	0.26	0.42	74%	458
110	29%	91%	0.21	0.24	0.39	74%	451
115	19%	94%	0.13	0.16	0.28	73%	466
120	13%	96%	0.09	0.12	0.21	73%	471

Note(s): Results displayed in nomophobia cutoff incremental of five points between NMPQ score of 50-120. Total observations 1731; area under curve 0.70 [0.66; 0.71]
Source(s): Table by authors



Source(s): Figure by authors

Figure 1. ROC curve for the nomophobia score (NMPQ) in predicting road safety

4. Discussion

The aim of the current study was to quantify the relationship between motorists' nomophobia and their level of road safety. In order to tailor interventions, establish a nomophobia cut-off value that would indicate inadequate traffic safety. The findings of this research suggest that nomophobia was quite common among adults. The prevalence of mild nomophobia, moderate nomophobia and severe nomophobia was 22%, 53% and 25%, respectively. Participants with a positive recent history of traffic contraventions appeared to have a higher score of nomophobia. Specifically, participants with severe nomophobia appeared to be four to six times more at increased risk of violating traffic rules and regulations. The original NMP-Q identified severe nomophobia at a cutoff score of 100. Results of the ROC suggest that a score of 90 (i.e., the upper limits of moderate nomophobia) was better used to identify motorists at risk. Using the "fail-safe" suggested score of 90 on the NMP-Q 90 can help in developing screening and intervention programs aimed at reducing nomophobia and may improve road safety among motorists.

The reported nomophobia rates are consistent with those found in the literature (Adawi *et al.*, 2018; Ahmed, Pokhrel, Roy, & Samuel, 2019; AlMarzooqi *et al.*, 2022; Bhattacharya, Bashar, Srivastava, & Singh, 2019; Cain & Malcom, 2019; Jahrami *et al.*, 2021a, b). A recent global systematic review and meta-analysis of twenty research studies involving about 12,500 participants showed that rates of moderate and severe nomophobia are 50–60% and 20–25%, respectively (Humood *et al.*, 2021).

Based on a recent reliability generalization meta-analysis (Jahrami *et al.*, 2023a), the internal consistency reported in the present study of the entire NMPQ and its subsets (dimensions or factors) was found to be high and consistent with those reported in the literature.

The results suggest that nomophobia affects both adult men and women of different ages. Previous research mainly demonstrated that age was not a significant factor in nomophobia because the severity of the symptoms was the same across all recognized age groups (Humood *et al.*, 2021; Moreno-Guerrero, Aznar-Díaz, Cáceres-Reche, & Rodríguez-García, 2020; Moreno-Guerrero, Hinojo-Lucena, Trujillo-Torres, & Rodríguez-García, 2021; Moreno-Guerrero, López-Belmonte, Romero-Rodríguez, & Rodríguez-García, 2020; Rodríguez-García, Belmonte, & Moreno-Guerrero, 2020; Rodríguez-García, Marín-Marín, López-Núñez, & Moreno-Guerrero, 2021). The present study suggests that nomophobia is slightly more prevalent in younger participants. Women appeared to have higher rates of nomophobia than men. However, the difference did not reach statistical significance (Adawi *et al.*, 2018; Al-Balhan *et al.*, 2018; Humood *et al.*, 2021; Jahrami *et al.*, 2021a, b; Lin, Griffiths, & Pakpour, 2018; Tams, Legoux, & Léger, 2018). It can be concluded that nomophobia affects both adult men and women of different age groups.

Severe nomophobia appeared to be a strong predictor of poor road safety. Recent research aimed to use nomophobia severity to predict illegal smartphone use while driving and concluded that higher levels of nomophobia increased the odds of illegal smartphone use (Kaviani *et al.*, 2022a, b; Kaviani, Young *et al.*, 2020a, b; Kaviani, Benier, *et al.*, 2021; Kaviani, Young *et al.*, 2021). The results are fully following the previously reported findings that severe nomophobia increased the odds of poor road safety by a factor up to six times higher compared to drivers with no nomophobia (Kaviani *et al.*, 2022a, b).

Previous research showed that anxious drivers are more likely to be distracted and have poor memory performance and processes while operating a vehicle (Pourabdian and Azmoon, 2013; Shahar, 2009).

The present study contributes a very novel finding that previous studies had overlooked: individuals with a higher-limit "moderate nomophobia," specifically an NMP-Q score of 90, are equally at risk for poor road safety as those with severe nomophobia. Insights from a recent cohort study suggest that symptoms of nomophobia worsen over time if left untreated. Previous research suggests that nomophobia involves more than a temporary fear of being without a mobile phone (AlMarzooqi *et al.*, 2022; da Silva, Rocha, Buheji, Jahrami, & Cunha, 2021; Humood *et al.*, 2021; Jahrami, 2023; Jahrami *et al.*, 2020, 2021a, b; Jahrami *et al.*, 2021a). For people with nomophobia, the symptoms do not go away and may get worse over time (Lin *et al.*, 2021). The symptoms can interfere with daily activities such as job performance, schoolwork and relationships, and they can also endanger one's own and others' safety. Nomophobia was also strongly associated with insomnia (Jahrami *et al.*, 2022), which may further cause dysfunctions in areas mentioned above (i.e., job performance, schoolwork, relationships and safety). Insomnia has been associated with impaired driving performance in laboratory and observational studies (Garbarino *et al.*, 2017). Significant risks of traffic accidents are linked to both insomnia and the use of sleep aids, presumably due to or in conjunction with some of their aftereffects during the day (i.e., fatigue and poor concentration) (Morin *et al.*, 2020). As for practical implications, the findings of the present study suggest that individuals with moderate-severe nomophobia should be screened for insomnia, as both symptoms (i.e., nomophobia and insomnia) are independent risk factors for poor road safety.

Primary areas of intervention to prevent and reduce nomophobia symptoms should be addressed as much as possible to reduce insomnia and dysfunctions in daily routine. Behavioral programs should be tailored to help individuals address the dysfunctions associated with nomophobia symptoms.

It's critical to increase awareness of the risks associated with mobile phone use while driving and to teach drivers safe driving techniques in order to address the issues of nomophobia and road safety. Designing phones with features that discourage excessive use, such as automatic shut-off after a set length of time or a notification system that prompts users to take a break from their phone, can help mobile phone manufacturers reduce nomophobia. Governments can also enact rules and legislation that forbid using cellphones while driving and inflict severe penalties on those who do.

The study has several strengths, including the use of a relatively large sample size, the use of an objective measure to quantify road safety and the use of a validated measure to quantify nomophobia symptoms. The study has some limitations. The major concern was that driving behaviors and habits were not measured and analyzed in the present study, therefore limiting the generalizability of the study. Motorcyclists were excluded from the study, and therefore further research is needed to target them as a special population. The convenience and non-probabilistic methods employed to choose the study's sample may be seen as one of the study's shortcomings.

Telecommunication companies can play an important role in road safety by supporting telematic systems (Wahlström, Skog, & Händel, 2017; Wilkinson & Taylor, 2020). Telematics uses GPS and onboard diagnostics (OBD) to track the movements of vehicles, machinery, and other assets and display that data on a computerized map (Wilkinson & Taylor, 2020). Such a system enables continuous monitoring of driver behavior and vehicle performance (Wilkinson & Taylor, 2020). It makes it possible to gain practical insights that enhance driving safety and lower injuries in society (Wahlström *et al.*, 2017; Wilkinson & Taylor, 2020).

5. Conclusion

Nomophobia symptoms are quite common among adults. Severe nomophobia is strongly associated with a high frequency of traffic contraventions among motorists. While the original developers of the nomophobia score (i.e., NMP-Q) have established that a score of 100 or more is the criterion for severe nomophobia, the reported analyses suggest a score of 90 or more is better at identifying risk drivers. Developing screening and intervention programs aimed at reducing nomophobia may improve road safety among motorists. Drivers who stopped frequently by the police for using a mobile phone are sent for screening and an awareness course.

Nomophobia is not proposed to be a standalone predictor of road safety. Rather, it is a possibly useful indicator that may help researchers and policymakers better understand how people's attachment to their devices may affect their driving. By itself, nomophobia cannot fully account for motorists' road safety, but it should be used in conjunction with other measures to improve our understanding of this important issue of dangerous smartphone use while driving.

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