

Translation, Validation and Reliability Testing of The Vision and Night Driving Questionnaire from English into the Malay Language

WOI PJ^{1*}, WAN DIN WMH¹, AZMI SYUKRI NS¹, ABD RAHMAN MH²,
MUTALIB HA¹, BHANDARI M³

¹Center for Community Health Studies (ReaCH), Optometry and Vision Science Programme, Universiti Kebangsaan Malaysia, 50300 Kuala Lumpur, Malaysia

²Center for Rehabilitation & Special Needs Studies (iCareRehab), Optometry and Vision Science Programme, Universiti Kebangsaan Malaysia, 50300 Kuala Lumpur, Malaysia

³School of Optometry, Faculty of Medicine & Health Sciences, UCSI University, 56000 Cheras, Kuala Lumpur, Malaysia

Received: 02 Apr 024 / Accepted: 11 Jun 2024

ABSTRAK

Pemanduan waktu malam adalah aspek penting dalam mobiliti, dan status penglihatan adalah salah satu faktor yang mempengaruhi prestasi pemanduan waktu malam. Soal Selidik Penglihatan dan Pemanduan Waktu Malam (VND-Q) yang mempunyai sembilan item dibangunkan untuk menilai kesukaran penglihatan semasa memandu waktu malam. Kajian ini bertujuan untuk menterjemahkan VND-Q versi Bahasa Inggeris ke Bahasa Melayu dan menentukan kesahan dan kebolehpercayaan VND-Q versi Bahasa Melayu (VND-Q-M) dalam kalangan penduduk Malaysia. Kaedah penterjemahan hadapan-belakang telah dilakukan untuk menterjemah VND-Q ke dalam Bahasa Melayu. Kesahan kandungan dinilai oleh enam pakar dalam bidang optometri. Seramai 120 orang pemandu dewasa Malaysia terlibat dalam pengesahan konstruk menggunakan analisis faktor penerokaan (EFA) dan ujian kebolehpercayaan menggunakan alpha Cronbach. Satu item telah dikeluarkan selepas mengambil kira pendapat semua pakar. Nilai indeks pengesahan kandungan (CVI) untuk perkaitan, kejelasan dan kebolehfahaman ialah 1.0, 0.98 dan 1.0, menunjukkan kesahan yang tinggi. Nilai *p* bagi ujian sfera Barlett adalah lebih kecil daripada 0.001 dan ukuran kecukupan pensampelan Kaisen-Meyer-Olkin (KMO) ialah 0.79. Melalui EFA, dua faktor telah diperolehi sebagai asas kepada soal selidik, yang mempunyai sejumlah lapan item (pemuatan faktor ≥ 0.4). Nilai alpha Cronbach ialah 0.84 untuk semua item, menunjukkan konsistensi dalaman yang tinggi. Kajian ini menyediakan bukti untuk ciri psikometrik VND-Q-M yang diubah suai. Keputusan kajian ini menunjukkan bahawa VND-Q-M yang diubah suai adalah instrumen yang sah dan

Address for correspondence and reprint requests: Woi Pui Juan. Center for Community Health Studies (ReaCH), Optometry and Vision Science Programme, Universiti Kebangsaan Malaysia, 50300 Kuala Lumpur, Malaysia. Tel: +603-9289 7480 Email: woipj@ukm.edu.my

boleh dipercayai untuk menilai kesukaran penglihatan semasa memandu waktu malam dalam kalangan populasi Malaysia.

Kata kunci: Analisis faktor; dapatan laporan pesakit; penterjemahan; kesahan dan kebolehpercayaan; penglihatan waktu malam

ABSTRACT

Night driving is an important aspect of mobility, and visual status is one of the factors responsible for night driving performance. The Vision and Night Driving Questionnaire (VND-Q) is a nine-item questionnaire developed to assess vision-related night driving difficulties. This study aimed to translate the English version of the VND-Q into Malay language and determine the validity and reliability of the Malay version of the VND-Q (VND-Q-M) among the Malaysian population. A forward-backward translation method was performed to translate the VND-Q into Malay language. Content validity was assessed by six experts in optometry. A total of 120 Malaysian adult drivers were involved in the construct validation using exploratory factor analysis (EFA) and reliability testing using Cronbach's alpha. An item was removed after taking into account the opinions of all the experts. The content validation index (CVI) values of 1.0, 0.98, and 1.0 for relevance, clarity, and understandability, respectively, indicated high validity. The p-value of Barlett's test of sphericity was smaller than 0.001 and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.79. Using EFA, two factors were extracted as underlying the questionnaire, which contained a total of eight items (factor loading 0.4). The internal consistency was high, with Cronbach's alpha value of 0.84 for all items. This study provides evidence that the modified VND-Q-M is a valid and reliable instrument for assessing vision-related night driving difficulties in the Malaysian population.

Keywords: Factor analysis; night vision; patient-reported outcome; translation; validity and reliability

INTRODUCTION

Night driving is a unique and challenging experience that requires heightened attention, adaptability and caution. As the sun sets and darkness envelops the surroundings, the world takes on a different character, presenting both visual and psychological obstacles for drivers. Night driving demands a distinct set of skills and concentration compared to daytime travel due to reduced visibility and increased

glare from headlights during nighttime (Wood et al. 2021). Numerous studies have demonstrated that nighttime is when fatal or severe traffic accidents frequently take place (Ashraf et al. 2019; Sapsirisavat et al. 2021; Shaadan et al. 2021; Vipin & Rahul 2021). When accounting for distance travelled, the risk of a pedestrian fatality is up to seven times higher during night driving compared to daytime driving (Sullivan & Flannagan 2002). Poor light

levels at night are thought to be the leading cause of nighttime accidents involving pedestrians, most likely owing to their decreased visibility (Owens et al. 1996; Sullivan & Flannagan 2002). The retinal illumination will decrease with a lower light level, which leads to a decrease in visual acuity (Wilkinson et al. 2020). Additionally, vision and night driving are significantly impacted by light and glare from road lighting and headlights, and these impacts are likely to change as technology advances, such as with light-emitting diode (LED) streetlighting and headlights (Wood 2020). The presence of glare from these light sources during night driving causes visual discomfort and visual impairment through increased intraocular light scatter and neural processes, leading to a persistent visual disability even after the glare source is removed (Boadi-Kusi et al. 2021; Plainis et al. 2005; Van Den Berg 1991).

A questionnaire was designed to evaluate a patient's self-reported outcome is referred to as a patient-reported outcome measure. Concept, construct, or domain refers to the outcome that is being evaluated, and items are referred to the specific questions that make up the patient-reported outcome measure (Weinfurt & Reeve 2022). The patient-reported outcome measure not only enhances the clinical diagnosis and documentation but also the communication between healthcare providers and patients (Hoffman et al. 2022). The Vision and Night Driving Questionnaire (VND-Q) is an open-access self-reported measure of vision-related night driving difficulties (Kimlin et al. 2016). The VND-Q comprises a range of items related to driving tasks that vary in difficulty level, such as judging the distance

to other moving cars and driving in poor weather at night. The VND-Q is frequently used to evaluate vision-related night driving challenges. The VND-Q scores have been shown to be associated with night driving performance in older drivers (Kimlin et al. 2020). Another study with drivers ranging in age from 20-72 years old revealed a positive correlation between age and VND-Q scores (Antwi-Adjei et al. 2021). A recent study investigated the relationship between drivers' self-reported driver skills and their perceived night driving difficulties using VND-Q among young and older drivers (Öztürk & Merat 2023). Interestingly, higher VND-Q scores were found in young drivers with higher self-reported safety skills but lower self-reported perceptual-motor skills. These findings emphasise the importance of understanding and addressing night driving difficulties, especially among different age groups, to enhance overall road safety.

With improving living standards, particularly in emerging economies, vehicle ownership becomes more attainable for a larger portion of the population (Chu et al. 2022). This phenomenon also overwhelms Malaysia; the active drivers in Malaysia are approximately 10.4 million (Malaysian Road Transportation Department 2023). Given the enormous number of drivers in Malaysia, a self-reported outcome measure like the VND-Q would be beneficial for healthcare professionals to evaluate patients' self-reported vision-related difficulties when driving at night. However, the VND-Q is developed for English speakers, but Malay is the official language and the most widely used language in Malaysia (Loi & Ku 2021). To date, there is no vision-related night

driving questionnaire for the visually normal population available in Malay. A translation of the English version of the VND-Q into Malay language is needed to ensure that the questionnaire accurately reflects the cultural and linguistic context of the target population and that the responses obtained are meaningful and relevant to the individual being assessed. The aim of this study was to translate the English version of the VND-Q into Malay language and establish the validity and reliability of the modified Malay version of the VND-Q (VND-Q-M) among the Malaysian population.

MATERIALS AND METHODS

Study Design

This study had two phases: (i) Phase I: translation of the English version of the VND-Q into Malay language and; (ii) Phase II: validation and reliability testing of the VND-Q-M. This study was approved by the Research Ethics Committee of Universiti Kebangsaan Malaysia (UKM

PPI/111/8/JEP-2022-103). All procedures were conducted in accordance with the Declaration of Helsinki. Electronic informed consent was obtained from all experts and participants involved in the study.

Instrument

The open-access original English version of the VND-Q is useful to assess self-reported vision-related night driving difficulties. It is a nine-item self-reported measure of vision-related night driving difficulties that uses a five-point Likert-type scale format, with responses ranging from one = "no difficulty" to five = "extreme difficulty" (Table 1). A higher score indicates greater vision-related night driving difficulties whereas a lower score indicates fewer difficulties. The VND-Q has been demonstrated to be unidimensional, valid, and reliable by Rasch analysis with a person separation index of 3.04 and a person reliability of 0.90 (Kimlin et al. 2016).

TABLE 1: Nine items of the VND-Q

Item
1- Seeing dark coloured cars when driving at night?
2- Seeing pedestrians or animals on the road side when driving at night?
3- Reading street signs when driving at night?
4- Seeing the road because of oncoming headlights when driving at night?
5- Seeing because of glare when driving at dawn or dusk?
6- Adjusting after passing headlights from oncoming cars when driving at night?
7- Judging the distance to your turn-off or exit while driving at night?
8- Judging the distance between you and other moving cars when driving at night?
9- Seeing the road in rain or poor weather when driving at night?
VND-Q: Vision and Night Driving Questionnaire

Phase I: Translation

Translation was performed according to the World Health Organisation's (WHO) guidelines on translation and adaptation of instruments, which included forward and backward translations. The English version of the VND-Q was first translated into Malay language with forward translation by a linguistic expert and a bilingual subject matter expert. A discussion was conducted among five bilingual authors to identify and resolve the inadequate expressions or concepts of the translation, as well as any discrepancies between the Malay version and the original English version of the VND-Q. Then, the VND-Q-M was translated into English language with backward translation by another pair of linguistic expert and bilingual subject matter expert. A discussion was conducted among the same five authors on the similarity between the backward translated English version and the original English version of the VND-Q.

Phase II: Validation and Reliability Testing

(i) Content Validation

Six bilingual experts in vision care were selected for the content validation of the VND-Q-M. Among the expert group, four of them were lecturers with PhD in optometry, and two of them were clinical optometrists at a university. All experts received written information via email about the objective of the study and their role as expert panels. All experts agreed to participate and returned the questionnaires within two weeks. The experts assessed all items in the VND-Q-M on relevance,

clarity, and understandability. They ranked each item on a 4-point Likert scale; 1 represented the lowest value and 4 represented the highest value. The experts were encouraged to provide written comments for each item and all comments were taken into consideration to refine the items.

(ii) Construct Validation

A total of 120 participants aged 20 to 42 years old (mean age=28.33 years 6.38) were recruited via purposive sampling for the construct validity of the modified VND-Q-M. The participants were chosen based on the following inclusion criteria: Malaysian, 19 to 45 years old, proficient in Malay, having an active driving license, at least one year of driving experience, currently driving at night at least once a week, most recent eye examination within the last 12 months, absence of ocular disease, no difficulty in seeing and recognising somebody known to them across the road in the past month. All participants completed the questionnaire via an openly accessible online survey platform, Google Form. The questionnaire consisted of two parts: demographic data and the modified VND-Q-M. The data were gathered over a 3-month period. Table 2 showed a summary of the participants' demographic characteristic.

(iii) Reliability

The internal consistency of the modified VND-Q-M was assessed using Cronbach's Alpha.

TABLE 2: Demographic characteristics of the participants (n=120)

	Category	Frequency (n)	Percentage (%)
Gender	Male	43	35.8
	Female	77	64.2
Occupation	Employed	73	60.8
	Student	47	39.2
Driving experience	1-2 years	35	29.2
	3-4 years	39	32.5
	5 years and more	46	38.3
Night driving frequency	1-2 times weekly	13	10.8
	3-4 times weekly	18	15.0
	5-6 times weekly	29	24.2
	Every day of the week	60	50.0

Statistical Analysis

The content validation index (CVI) was calculated based on the experts' ratings. Two types of CVI were calculated in this study, which were item-level content validity index (I-CVI) and scale-level content validity index (S-CVI) (Yusoff 2019). Two methods were performed to calculate S-CVI, which were the average of the I-CVI scores for all items on the scale (S-CVI/Ave) and the proportion of items on the scale that achieved a scale of 3 or 4 by all experts (S-CVI/UA) (Polit & Beck 2006). The S-CVI/UA was based on the universal agreement (UA) method, where 1 was given when the item achieved 100% agreement from experts, otherwise the UA score was given as 0. The acceptable CVI value was at least 0.83 for an expert group of six (Polit et al. 2007; Polit & Beck 2006). The Statistical Package for Social Sciences (SPSS) Version 28.0 (IBM Corp, Armonk, NY) was used to perform construct validation and reliability analysis. To determine the construct validity, an exploratory factor analysis (EFA) using

principal axis factoring (PAF) method with Promax rotation was conducted. The EFA assumptions were checked to ensure the correlation matrix was factorable. The Barlett's test of sphericity with a p-value smaller than 0.05 and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy greater than 0.50 were applied in this study. The communality values must be greater than 0.2 (Child 2006) and the number of factors to be retained was observed by positive eigenvalues must be greater than one (Yong & Pearce 2013). The total variance explained by the retained factors must be at least 50% (Samuels 2017). For reliability analysis, an alpha coefficient greater than 0.7 was considered to have good reliability (Terwee et al. 2007). Mann-Whitney U test was used to compare the modified VND-Q-M score between genders.

RESULTS

Content Validation

Table 3 showed the I-CVI and S-CVI

values of the nine-item VND-Q-M. The S-CVI/Ave values for all three components (relevance=0.98, clarity=0.93, and understandability=0.94) were greater than 0.83. However, the I-CVI values for clarity and understandability of Item 6 were only 0.50. Three out of the six experts commented that the purpose of Item 6 could be confused with that of Item 4. Both items were related to the vision affected by oncoming headlights from vehicles during night driving. Item 4 inquired about the difficulty of seeing the road because of oncoming headlights when driving at night, while Item 6 inquired about the difficulty of adjusting after passing headlights from oncoming cars when driving at night. Item 4 was precisely asking for road visibility, but it was not clear that the term “adjusting” in Item 6 was referring to the vision or the vehicle. A harmonised meeting was conducted among authors

and the discrepancies were discussed before any amendment was made to the questionnaire.

Following the discussion and taking all the experts’ input into consideration, Item 6 was removed. Item 4, Item 7, and Item 9 were rephrased based on the suggestions of experts. The CVI values for all components were recalculated after the amendment. All I-CVI and S-CVI values of the eight-item VND-Q-M were equal to or greater than 0.83 (Table 4). The final version of VND-Q-M was available in Appendix 1.

Construct Validation

The mean score for the modified VND-Q-M among 120 participants was 18.18 ± 5.44. The p-value of Barlett’s test of sphericity was smaller than 0.001 and the KMO measure of sampling adequacy

TABLE 3: The CVI values for the nine-item Malay version of the VND-Q by six experts

Item	Relevance			Clarity			Understandability		
	Experts in agreement	I-CVI	UA	Experts in agreement	I-CVI	UA	Experts in agreement	I-CVI	UA
1	6	1.0	1	6	1.0	1	6	1.0	1
2	6	1.0	1	6	1.0	1	6	1.0	1
3	6	1.0	1	6	1.0	1	6	1.0	1
4	6	1.0	1	5	0.83	0	6	1.0	1
5	6	1.0	1	6	1.0	1	6	1.0	1
6	5	0.83	0	3	0.50	0	3	0.5	0
7	6	1.0	1	6	1.0	1	6	1.0	1
8	6	1.0	1	6	1.0	1	6	1.0	1
9	6	1.0	1	6	1.0	1	6	1.0	1
	S-CVI/Ave	0.98		S-CVI/Ave	0.93		S-CVI/Ave	0.94	
	S-CVI/UA		0.89	S-CVI/UA		0.78	S-CVI/UA		0.89

I-CVI: item-level content validity index; UA: universal agreement (1: achieve 100% expert agreement; 0: do not achieve 100% expert agreement); S-CVI/Ave: average of the I-CVI scores for all items on the scale; S-CVI/UA: proportion of items on the scale that achieve a scale of 3 or 4 by all experts; VND-Q: Vision and Night Driving Questionnaire

TABLE 4: The CVI values for the eight-item Malay version of the VND-Q by six experts (Item 6 was removed)

Item	Relevance			Clarity			Understandability		
	Experts in agreement	I-CVI	UA	Experts in agreement	I-CVI	UA	Experts in agreement	I-CVI	UA
1	6	1.0	1	6	1.0	1	6	1.0	1
2	6	1.0	1	6	1.0	1	6	1.0	1
3	6	1.0	1	6	1.0	1	6	1.0	1
4	6	1.0	1	5	0.83	0	6	1.0	1
5	6	1.0	1	6	1.0	1	6	1.0	1
7	6	1.0	1	6	1.0	1	6	1.0	1
8	6	1.0	1	6	1.0	1	6	1.0	1
9	6	1.0	1	6	1.0	1	6	1.0	1
	S-CVI/Ave	1.0		S-CVI/Ave	0.98		S-CVI/Ave	1.0	
	S-CVI/UA		1.0	S-CVI/UA		0.88	S-CVI/UA		1.0

I-CVI: item-level content validity index; UA: universal agreement (1: achieve 100% expert agreement; 0: do not achieve 100% expert agreement); S-CVI/Ave: average of the I-CVI scores for all items on the scale; S-CVI/UA: proportion of items on the scale that achieve a scale of 3 or 4 by all experts; VND-Q: Vision and Night Driving Questionnaire

was 0.79. The sample was proved adequate for factor analysis. Two factors with eigenvalues greater than one (Factor 1=3.83, Factor 2=1.17) were identified as underlying the eight items. The two-factor model accounted for 51.24%

(Factor 1=42.14%, Factor 2=9.10%) of the variance in the questionnaire data with a factor correlation of 0.57. Factor 1 was labelled “visibility” while Factor 2 labelled “distance judgement”. Factor loading for each item was listed in Table 5. All factors

TABLE 5: EFA for the modified Malay version of the VND-Q (PAF with Promax rotation)

Item	Factor	
	Visibility	Distance judgement
1- Seeing dark coloured cars when driving at night?	0.74*	-0.07
2- Seeing pedestrians or animals on the road side when driving at night?	0.93*	-0.12
3- Reading street signs when driving at night?	0.67*	-0.41
4- Seeing the road because of oncoming headlights when driving at night?	0.63*	0.17
5- Seeing because of glare when driving at dawn or dusk?	0.40*	0.12
7- Judging the distance to your turn-off or exit while driving at night?	-0.09	0.84*
8- Judging the distance between you and other moving cars when driving at night?	-0.01	0.68*
9- Seeing the road in rain or poor weather when driving at night?	0.45	0.42

EFA: exploratory factor analysis; PAF: principal axis factoring; VND-Q: Vision and Night Driving Questionnaire

had loadings at values of 0.40 or greater. Item 1 to Item 5 were loaded on the “visibility” factor, while Item 7 and Item 8 were loaded on the “distance judgement” factor. Item 4, Item 5 and Item 9 had cross-loadings, but the ratios of loadings were smaller than 75% for Item 4 and Item 5 (Samuels 2017). Item 9 had almost equal loading on both factors. Hence, it was not categorised as either of these factors.

Reliability

The Cronbach’s alpha value for “visibility” factor (Item 1 to Item 5) was 0.80 while for “distance judgement” factor (Item 7 and Item 8) was 0.70. When Item 9 was added and all eight items were included in the reliability analysis, the Cronbach’s alpha value was the highest, which was 0.84. Overall, the results indicated the modified VND-Q-M had a good level of internal consistency.

DISCUSSION

This study aimed to translate and validate the VND-Q-M among the Malaysian population. The use of culturally adapted assessment instruments is particularly crucial in the healthcare sector because it can affect clinical decision-making (Pan et al. 2018). The forward and backward translation methods were applied to the translation process. The content validation and construct validation were conducted on the translated questionnaire, followed by a reliability analysis. This study demonstrates that the modified VND-Q-M is valid and reliable to be used for measuring the self-reported night driving difficulties in Malaysian drivers.

The I-CVI values for clarity and

understandability of Item 6 were lower than 0.83. The experts questioned the similarity of Item 4 and Item 6. A good item in a questionnaire must be concise and address a single idea to avoid ambiguity (Singh 2017). The consensus was reached that Item 6 should be removed. For Item 4, Item 7 and Item 9, some prepositions were rephrased, such as from “*akibat*” to “*disebabkan*” (from “due to” to “because of” in English) to further improve sentence fluency. The I-CVI and S-CVI values increased after the removal of Item 6. These findings indicate that the modified VND-Q-M has a high relevance to the target measurement content, good clarity and is easily understood.

In construct validation, the EFA revealed a two-factor structure of the modified VND-Q-M. All factor loadings were equal to or greater than 0.40, which was considered high and stable (Guadagnoli & Velicer 1988). The “visibility” factor consisted of five items, Item 1 to Item 5. These items all referred to the target visibility when driving at night. These items asked about the visibility of dark-coloured cars, pedestrians, animals, street signs and roads during night driving, and the effect of glare on visibility under low illumination conditions. Visibility during night driving is highly affected by ambient lighting sources, headlights from the driver’s own vehicle and that of oncoming vehicles. According to a Cochrane review on road lighting and crashes, installing streetlights on dark roads can lower the risk of a crash at night by 55% (Beyer & Ker 2009). Vehicles with better headlight visibility have also been found to have lower nighttime crash rates (Brumbelow 2022). Glare from oncoming vehicles during night driving reduces the driver’s

visibility, which can contribute to traffic accidents (Bullough et al. 2008). These studies provide evidence that the visibility of drivers is one of the key contributing factors in determining the difficulty level of night driving.

Factor 2 (distance judgement) consisted of two items that described the distance judgement during night driving. Item 7 asked about the distance judgement for turn-off or exit during night driving, while Item 8 questioned the distance judgement between the driver's own vehicle and other moving vehicles during night driving. The accuracy of distance judgement based on motion perception plays a role in the measurement of night driving difficulties. Most drivers make decisions based on the speed and distance of oncoming vehicles when they are waiting to pull out of the junction. A previous study has shown that there is a decrease in the accuracy of vehicle speed and distance judgement during nighttime condition (Gould et al. 2012). This could be due to the fact that motion perception is impaired at night because of the poor temporal processing characteristics of the rod photoreceptors, with moving targets seeming to move slower than they are during daytime condition (Gegenfurtner et al. 1999).

Item 9 had similar cross-loading on "visibility" and "distance judgement" factors. This item asked about the road visibility in rain or poor weather during night driving. With this item, unlike the others, there is an extra consideration: the weather condition. The poor weather conditions exacerbate the difficulty of night driving. Drivers tend to reduce their vehicle speed in poor weather conditions (rain or snow), and the speed reduction is more pronounced under low lighting

conditions (Jägerbrand & Sjöbergh 2016). Malaysia experiences humid weather throughout the year with an annual rainfall of 80% per year, which is between 2000 mm and 2500 mm (Department of Information Malaysia 2023). The chance to drive at night during rain is high in Malaysia. Therefore, Item 9 was retained due to its significance in the Malaysian context. Internal consistency reliability analysis also suggested all eight items of the VND-Q-M should be included. The high Cronbach's alpha values of the modified VND-Q-M demonstrate unequivocally that the questionnaire is reliable for usage. The original English version of the VND-Q is developed for use among the general older population. The inclusion criteria for this study required the participants to be younger in order to rule out age-related ocular changes—nuclear sclerosis, which is known to be associated with self-reported driving difficulties during both the day and at night (Abd Rahman et al. 2021; Abd Rahman et al. 2022). With younger participants, this study still demonstrated the good validity and reliability of the questionnaire. This suggests that the items of the modified VND-Q-M are appropriate for the young population as well. The majority of drivers in Malaysia who are actively driving are between the ages of 17 and 31 (34.7%), followed by those between the ages of 32 and 41 (24.2%) (Malaysian Road Transportation Department 2023). It is important to ensure the age diversity of the modified VND-Q-M so that a wide age range of drivers, including young drivers in Malaysia, are suitable to answer the questionnaire.

This study has a few limitations. First, the participants were recruited via purposive sampling and therefore may

not be generalised to the entire Malaysian population. A diverse combination of participants from different regions of the country is recommended. Second, the participants were recruited based on their self-reported vision status. Further investigation is needed through exploration of how self-reported night driving difficulties as assessed by the modified VND-Q-M relate to clinical measures of visual function and night driving performance.

CONCLUSION

The CVI values of the modified VND-Q-M were high, indicating excellent validity of the instrument in terms of relevance (1.0), clarity (0.98) and understandability (1.0). The KMO value of 0.79 showed good sampling adequacy. Additionally, the internal consistency value was 0.84 for all items, demonstrating high reliability. In summary, the translation, validation and reliability analyses provided strong evidence that the modified VND-Q-M is a valid and reliable instrument for assessing self-reported vision-related night driving difficulties among the Malaysian population. This instrument can provide quick yet crucial information regarding the vision of night driving, which can be a support resource for healthcare professionals in making clinical decisions during patient management. Future studies can explore the potential utility of the modified VND-Q-M as a screening tool in clinical settings to identify individuals who may require vision assessments, counselling, or interventions specifically focus on addressing night driving challenges.

ACKNOWLEDGEMENT

The authors wish to thank all the experts and participants for their contribution to this study. This study is supported by the Universiti Kebangsaan Malaysia under the Young Lecturers Incentive Grant (GGPM) (Code: GGPM-2021-034).

REFERENCES

- Abd Rahman, M.H., Abdul Mutalib, H., Mohd Norizan, N.H., Md-Muziman-Syah, M.M. 2022. Self-reported driving difficulty in patients with bilateral cataract. *J Optom* 15(4): 313-8.
- Abd Rahman, M.H., Mohd Norizan, N.H., Abdul Mutalib, H., Md-Muziman-Syah, M.M. 2021. Comparison of driving difficulty between bilateral cataract and non-cataract elderly drivers in Malaysia: A preliminary study. *Jurnal Sains Kesihatan Malaysia* 19(01): 143-9.
- Antwi-Adjei, E.K., Addo, E.A., Dadzie, E.E., OwusuPoku, E. 2021. Assessment of night vision problems among drivers in Ghana. *Invest Ophthalmol Vis Sci* 62(8): 3510.
- Ashraf, I., Hur, S., Shafiq, M., Park, Y. 2019. Catastrophic factors involved in road accidents: Underlying causes and descriptive analysis. *PLoS One* 14(10): 1-29.
- Beyer, F.R., Ker, K. 2009. Street lighting for preventing road traffic injuries. *Cochrane Database Syst Rev* (1): CD004728.
- Boadi-Kusi, S.B., Austin, E., Abu, S.L., Holdbrook, S., Morny, E.K.A. 2021. Disability glare and nighttime driving performance among commercial drivers in Ghana. *J Occup Health* 63(1): 1-9.
- Brumbelow, M.L. 2022. Light where it matters: IIHS headlight ratings are correlated with nighttime crash rates. *J Saf Res* 83: 379-87.
- Bullough, J.D., Skinner, N.P., Pysar, R.M., Radetsky, L.C., Smith, A.M., Rea, M.S. 2008. *Nighttime glare and driving performance: Research findings*. U.S. Department of Transportation, National Highway Traffic Safety Administration.
- Child, D. 2006. *The essentials of factor analysis*. New York: Continuum.
- Chu, M.Y., Law, T.H., Hamid, H., Law, S.H., Lee, J.C. 2022. Examining the effects of urbanization and purchasing power on the relationship between motorcycle ownership and economic development: A panel data. *Int J Transp Sci Technol* 11(1): 72-82.
- Department of Information Malaysia. Malaysia information/Climate. <https://www.malaysia.gov>.

- my/portal/content/144 [30 October 2023].
- Gegenfurtner, K.R., Maysner, H., Sharpe, L.T. 1999. Seeing movement in the dark. *Nature* **398**(6727): 475-6.
- Gould, M., Poulter, D.R., Helman, S., Wann, J.P. 2012. Errors in judging the approach rate of motorcycles in nighttime conditions and the effect of an improved lighting configuration. *Accid Anal Prev* **45**: 432-7.
- Guadagnoli, E., Velicer, W.F. 1988. Relation of sample size to the stability of component patterns. *Psychol Bull* **103**(2): 265-75.
- Hoffman, A.L., Thompson, Z.P., Rogers, T.S. 2022. Can patient-reported outcome measures improve clinical management and patient care? *Am Fam Physician* **106**(2): 134-6.
- Jägerbrand, A.K., Sjöbergh, J. 2016. Effects of weather conditions, light conditions, and road lighting on vehicle speed. *SpringerPlus* **5**(505): 1-17.
- Kimlin, J.A., Black, A.A., Djaja, N., Wood, J.M. 2016. Development and validation of a vision and night driving questionnaire. *Ophthalmic Physiol Opt* **36**(4): 465-76.
- Kimlin, J.A., Black, A.A., Wood, J.M. 2020. Older drivers' self-reported vision-related night-driving difficulties and night-driving performance. *Acta Ophthalmol* **98**(4): e513–e519.
- Loi, C., Ku, C. 2021. Language practice and language ideology on linguistic landscape in Malaysia. *Int J Soc Sci Res* **3**(3): 95-111.
- Malaysian Road Transportation Department. Number of active drivers by gender and state. [online]. <https://www.jpj.gov.my/en/web/main-site/seranta-atas-talian> [12 October 2023].
- Owens, D.A., Colledge, M., Sivak, M. 1996. Differentiation of visibility and alcohol as contributors to twilight road fatalities. *Hum Factors* **38**(4): 680-9.
- Öztürk, I., Merat, N. 2023. Driving at night and how it's influenced by perceived driver skills. In *Ergonomics & Human Factors*; 1-8.
- Pan, A.W., Wu, C.Y., Chung, L.I., Chen, T.J. 2018. Reliability and validity of the self-reported activities of daily living scale for people with mental illness. *Hong Kong J Occup Ther* **31**(2): 115-24.
- Plainis, S., Murray, I.J., Charman, W.N. 2005. The role of retinal adaptation in night driving. *Optom Vis Sci* **82**(8): 682-8.
- Polit, D.F., Beck, C.T. 2006. The content validity index: Are you sure you know what's being reported? Critique and recommendations. *Res Nurs Health* **29**(5): 489-97.
- Polit, D.F., Beck, C.T., Owen, S.V. 2007. Focus on research methods: Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Res Nurs Health* **30**(4): 459-67.
- Samuels, P. 2017. Advice on Exploratory Factor Analysis. *Birmingham City University*: 1-8.
- Sapsirisavat, V., Mahikul, W., Desapriya, E., Okamura, K. 2021. Drinking and night-time driving may increase the risk of severe health outcomes: A 5-Year retrospective study of traffic injuries among international travelers at a University Hospital Emergency Center in Thailand. *Int J Environ Res Public Health* **18**(9823): 1-9.
- Shaadan, N., Azhar Suhaimi, M.I.K., Hazmir, M.I., Hamzah, E.N. 2021. Road accidents analytics with data visualization: A case study in Shah Alam Malaysia. *J Phys Conf Ser* **1988**(1): 1-14.
- Singh, A.S. 2017. Common procedures for development, validity and reliability of a questionnaire. *Int J Econ Commer Manag* **5**(5): 790-801.
- Sullivan, J.M., Flannagan, M.J. 2002. The role of ambient light level in fatal crashes: Inferences from daylight saving time transitions. *Accid Anal Prev* **34**: 487-98.
- Terwee, C.B., Bot, S.D.M., de Boer, M.R., van der Windt, D.A.W.M., Knol, D.L., Dekker, J., Bouter, L.M., de Vet, H.C.W. 2007. Quality criteria were proposed for measurement properties of health status questionnaires. *J Clin Epidemiol* **60**(1): 34-42.
- Van Den Berg, T.J.T.P. 1991. On the relation between glare and straylight. *Doc Ophthalmol* **78**(3): 177-81.
- Vipin, N., Rahul, T. 2021. Road traffic accident mortality analysis based on time of occurrence: Evidence from Kerala, India. *Clin Epidemiol Global Health* **11**(100745): 1-8.
- Weinfurt, K.P., Reeve, B.B. 2022. Patient-reported outcome measures in clinical research. *JAMA* **328**(5): 472-3.
- Wilkinson, M.O., Anderson, R.S., Bradley, A., Thibos, L.N. 2020. Resolution acuity across the visual field for mesopic and scotopic illumination. *J Vis* **20**(10): 1-16.
- Wood, J.M. 2020. Nighttime driving: Visual, lighting and visibility challenges. *Ophthalmic Physiol Opt* **40**(2): 187-201.
- Wood, J.M., Chiu, C.N., Kim, G.H., Le, J., Lee, H.J., Nguyen, T., Black, A.A. 2021. Refractive blur affects judgement of pedestrian walking direction at night. *Ophthalmic Physiol Opt* **41**(3): 582-90.
- Yong, A.G., Pearce, S. 2013. A beginner's guide to factor analysis: Focusing on exploratory factor analysis. *Tutorials in Quant Methods Psychol* **9**(2): 79-94.
- Yusoff, M.S.B. 2019. ABC of content validation and content validity index calculation. *Educ Med J* **11**(2): 49-54.