

## Quality of Life in Patients with Neovascular Age Related Macular Degeneration (n-AMD) Seen in a Public Hospital of Malaysia

(Kualiti Hidup Pesakit dengan Neovascular Degenerasi Makular Berkaitan Umur (n-AMD) yang dilihat Hospital Awam di Malaysia)

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### ABSTRACT

*The purpose of the present study was to assess quality of life (QOL) in n-AMD patients seen in a Malaysian public hospital and to further identify visual and demographic factors that may contribute to QOL scores of these patients. Patients with any form of n-AMD in at least one eye were recruited from hospital's ophthalmology department. Bahasa Malaysia version of National Eye Institute Visual function questionnaire-25 (NEI-VFQ-25) was administered to all participants. Demographics, visual functions (VF) including best corrected distance visual acuity (BCDVA), contrast sensitivity (CS), near visual acuity (NVA) and reading speed (RS) were recorded. Eighty-six patients (Malay=26, Indian=23, Chinese=37) aged 52 to 85 years, diagnosed with n-AMD were chosen to participate. Their mean NEI-VFQ composite score (NEI-VFQ CS) was  $66.91 \pm 13.07$ . However, no significant difference in NEI-VFQ CS between gender, races and between the two sub groups of n-AMD were observed ( $p > 0.05$ ). NEI-VFQ CS showed a significant association with RS (correlation coefficient ( $\rho$ ) = 0.627), NVA ( $\rho$  = -.660), BCDVA ( $\rho$  = -.586), CS ( $\rho$  = .0515). A linear model showed that a combination of BCDVA, NVA, CS is accounted for a significant 38 % variability of NEI-VFQ CS ( $R^2$  = 0.382,  $p < 0.001$ ). In conclusion, the QOL of Malaysian n-AMD patients were found to be low. Thus, the study results indicated the need of developing necessary management strategies to address this QOL issues in n-AMD patients in Malaysia. Furthermore, the present study suggested incorporating appropriate VF such as near acuity, contrast sensitivity, reading speed in clinical settings while assessing n-AMD patients as these VF explain the patient's perception about the impact of this disease.*

**Keywords:** Neovascular AMD (n-AMD); visual functions (VF); vision targeted quality of life (VTQOL)

### ABSTRAK

*Tujuan penyelidikan ini adalah untuk menilai kualiti hidup (QOL) dalam pesakit n-AMD yang mendapat rawatan di hospital awam Malaysia dan seterusnya mengenal pasti faktor visual dan demografi yang mungkin menyumbang kepada markah QOL bagi pesakit ini. Pesakit yang mempunyai n-AMD pada sekurang-kurangnya satu mata telah diambil daripada jabatan oftalmologi hospital. Soal selidik-25 (NEI-VFQ-25) fungsi Institut Visual Mata Nasional versi Bahasa Malaysia diberikan kepada semua peserta. Demografi, fungsi visual (VF) termasuk jarak visual ketajaman diperbetulkan terbaik (BCDVA), sensitiviti kontra (CS), ketajaman visual dekat (NVA) dan kelajuan bacaan (RS) telah direkodkan. Enam puluh lapan pesakit (Melayu = 26, India = 23, Cina = 37) berumur antara 52 dan 85 tahun, didiagnos dengan n-AMD telah memilih untuk mengambil bahagian. Min skor komposit NEI-VFQ (NEI-VFQ CS) mereka ialah  $66.91 \pm 13.07$ . Walau bagaimanapun, tiada perbezaan yang signifikan dalam NEI-VFQ CS antara jantina, kaum dan antara dua kumpulan kecil n-AMD diperhatikan ( $p > 0.05$ ). NEI-VFQ CS menunjukkan hubungan bererti dengan RS (pekali korelasi ( $\rho$ ) = 0.627), NVA ( $\rho$  = -.660), BCDVA ( $\rho$  = -.586), CS ( $\rho$  = .0515). Model linear menunjukkan bahawa gabungan BCDVA, NVA, CS menerangkan perbezaan 38% CS NEI-VFQ ( $R^2$  = 0.382,  $p < 0.001$ ) yang ketara. Kesimpulannya, QOL n-AMD pesakit Malaysia didapati adalah rendah. Oleh itu, keputusan kajian menunjukkan perlunya keperluan membangunkan strategi pengurusan untuk mengatasi isu QOL pada pesakit n-AMD di Malaysia. Selain itu, kajian kini mencadangkan penggabungan VF yang sesuai seperti ketajaman dekat, sensitiviti kontra, kelajuan membaca dalam situasi klinikal sambil menilai pesakit n-AMD apabila VF ini menerangkan kepada persepsi pesakit tentang kesan penyakit ini.*

**Kata kunci:** Fungsi visual (VF); neovaskular AMD (n-AMD); Visi sasaran kualiti hidup (VTQOL)

### INTRODUCTION

Quality of life (QOL) is a measure of physical, functional, psychological and social well-being of an individual. Measurement of health related QOL in a diseased population provides patient's perception about the impact of the

disease and its treatment which is not obtained in testing clinical parameters. Thus, in patient-centred model of health care, measuring QOL in a diseased individual is emphasised more (Centres for Disease Control and Prevention 2013; Rebollo & Ortega 2001).

Age related macular degeneration (AMD) is one of the major causes of blindness in the elderly (WHO Visual impairment and blindness 2014). Although AMD is thought to be more prevalent in western countries, recent researches in Asian countries have reported AMD as a major visual concern of aged population (Li et al. 2008; Mohamad et al. 2017; Oshima et al. 2001; Sanjay et al. 2009). It causes central loss of vision affecting the person's ability to perform day to day activities. Several researches on AMD have reported that it negatively affects the individual's quality of life restricting many domains of life (Berdeaux et al. 2005; Clemons et al. 2003; Hassell et al. 2006; Mitchell et al. 2006). However, it has also been suggested that investigations on QOL should be measured in different types of AMD as treatment types and courses varies with the disease type (Taylor et al. 2016; Yuzawa et al. 2013).

Neovascular AMD (n-AMD) is the most debilitating form of AMD causing significant visual impairment. Introduction of anti-vascular endothelial growth factor (anti-VEGF) in treating n-AMD has reduced the blindness caused by this sight threatening condition (Martin et al. 2011). However, it requires long term treatment and monitoring. Thus, there is a recent trend to evaluate the quality of life in n-AMD and its treatment effect (Bertelmann et al. 2016; Matamoros et al. 2015; Yuzawa et al. 2013). However, there are limited literatures available in Asia apart from Singapore eye disease study where it is found that both typical Neovascular AMD and polypoidal choroidal vasculopathy (PCV), a distinct type of Neovascular AMD, possesses noticeable impact on the vision related quality of life in Asians (Fenwick et al. 2017a). Another study, conducted in Singapore, reported that early and late AMD negatively affected the vision specific functioning (VSF) in Chinese subjects. However, no or comparatively less effect of AMD on VSF was found in Indian and Malay subjects living there (Fenwick et al. 2017b). Furthermore, a recent research suggested demographics of patients receiving anti-VEGF treatment including patients with n-AMD, varies from region to region (Ziemssen et al. 2017). Thus, it is also important to explore impact n-AMD on individuals QOL in each population.

Although QOL has been reported in eye diseases like cataract, glaucoma, and diabetic retinopathy in multi-ethnic Malaysian population (Chandramohan et al. 2017; Omar et al. 2014; Rizal et al. 2007), there is no published data on QOL in any form of AMD patients in Malaysia. Thereby the purpose of this cross sectional observational study was to evaluate the vision targeted QOL in n-AMD patients in a public hospital of Malaysia and to further investigate the demographic and visual factors that may be associated with the QOL score in these patients. This will enhance our understanding about the patient's perceived impact of n-AMD in Malaysian population and will eventually assist in strengthening the existing management policy of n-AMD in Malaysia.

## MATERIALS AND METHODS

### SUBJECTS AND DEMOGRAPHICS

Individuals who are already undergoing anti-VEGF treatment or are scheduled for first dose of anti-VEGF treatment for any form of neovascular age related macular degeneration in at least one eye was recruited between December 2016 and August 2017 from a Malaysian public hospital for this cross sectional observational study. Subgroup classification of n-AMD was done as typical n-AMD and AMD with polypoidal choroidal vasculopathy (PCV) based on fundus fluorescein angiography (FFA), indocyanine green angiography (ICGA) and Optical Coherence Tomography (OCT) findings by a senior ophthalmologist. Treatment course and type may vary between these two subgroups causing different impact on QOL. Thereby, they were reported separately. Demographic information such as age, gender, race, duration of disease, number of injections were recorded.

### VISUAL FUNCTIONS

Visual functions including distance and near visual acuity, contrast sensitivity and reading speed was evaluated. A 4 meter ETDRS (Early Treatment Diabetic Retinopathy Study) chart was used to measure the best corrected distance visual acuity (BCDVA) at 4 meter. If any of the subjects were not able to read the top line at 4 meter, the chart was moved to 3, 2 and 1 meters until the patient could read the top line. Conversion of visual acuity at the particular distance was performed. Visual acuity was recorded in logMAR for ease of analysis. Near visual acuity (NVA) was measured as the threshold print size that was read by the subject with best spectacle correction in logMAR using UiTM Malay related-word reading chart at a standard distance of 40 cm. Contrast sensitivity (CS) was measured using Pelli-Robson chart at 1 m. Contrast score based on the contrast of last group in which two or three letters were correctly read by the subject was recorded. Reading speed (RS) was measured using UiTM related-word reading chart in subjects who were fluent with Malay. It is a validated Malay language reading chart that has been already described earlier (Buari et al. 2015). Reading speed was recorded in words per min. Reading speed was measured using the method recommended by the chart developers (Buari et al. 2015). However, in a multi-ethnic study population not all subjects could read Malay fluently. Thereby reading speed was not measured in all subjects.

### NEI-VFQ-25

Vision targeted quality of life using National Eye Health Visual function Questionnaire - 25 in Bahasa Malaysia (NEI-VFQ-25 in BM) (Rahman et al. 2015) was used to measure the quality of life. NEI-VFQ was originally developed with 51 items to assess impact of eye diseases on functional activities and well-being of an individual (Mangione et al. 1998). Later, a shorter version was developed with 25

items and named NEI-VFQ 25 (Mangione et al. 2001). This well accepted vision targeted QOL measuring tool has been translated and validated in different languages. NEI-VFQ-25 shows individual's self-perceived visual function in 11 different subscales including general health; general vision; ocular pain; near activities; distance activities; driving; colour vision; peripheral vision and social functioning; role difficulties; and dependency. NEI-VFQ is a well-established tool for measuring vision targeted quality of life in AMD population (Clemons et al. 2003). Furthermore, it has also been proved to be a reliable and valid tool to assess QOL in patients with AMD (Orr et al. 2011; Revicki et al. 2010).

*Scoring of NEI- VFQ* Composite score of NEI-VFQ (NEI-VFQ CS) was calculated as per previously described method (Broman et al. 2001). The subscale scores were 0-100, where a higher NEI-VFQ-25 score indicates better vision related quality of life.

#### STATISTICAL ANALYSIS

All the data were analysed using SPSS software. Descriptive statistics, analysis of variance (ANOVA) and independent t-test were employed to compare the NEI-VFQ CS between groups. Bi-variate and partial correlation followed by multiple regression analysis were done to draw the association between the NEI-VFQ CS and visual and demographic factors. Although NEI-VFQ CS being the dependant variable was normally distributed, many of the predicting factors were not normal. For non-normally distributed data, a Spearman's correlation was used. Furthermore, a multiple regression test was run to examine the relationship between NEI-VFQ score and the visual functions including BCDVA, NVA and CS and to find out predictor of NEI-VFQ CS. However, reading speed was not included as reading speed was measured only in 59 patients. Thereby, the recommendation of  $N=50+8K$  by Tabachnick and Fidell (1996) were followed, where  $N$ =number of cases and  $K$ =number of Predictors.

Ethics approval was obtained from Medical Research Ethics Committee of National Medical Research Register (NMRR-16-1965-31826 (IIR)) and Universiti Kebangsaan Malaysia Research and Ethics Committee (UKM 1.5.3.5/244/NN-186-2014) which follows the tenants of Helsinki. Written consent was obtained from all the participants. Demographic information including subject's age, gender, ethnicity, duration of disease and number of anti-VEGF injections were recorded.

#### RESULTS

A total of 86 subjects (47 male and 39 female) with an age range of 52 to 85 years (mean age  $69.49 \pm 8.21$  years) already undergoing treatment or scheduled for first dose of anti-VEGF injection for some form of n-AMD were recruited for the study. Fifty-one subjects (59.30%) had PCV in at least one eye and 56 subjects (60.47%) had some form of AMD in the fellow eye. Twelve subjects (14%) were undergoing

treatment in both eyes. Cataract, glaucoma, high myopia were among the other diagnosis of the fellow eye. However, in 12 of the fellow eyes, no abnormality was detected.

There were 26 Malays (30.23%), 23 Indians (26.74%) and 37 Chinese (43.02%) subjects. Fifty-seven subjects had undergone 3 or less anti-VEGF injections whereas 29 subjects had undergone 4 or more anti-VEGF injections. Thirty subjects reported history of experiencing some form of visual difficulties for less than 6 months whereas 21 and 35 subjects reported duration of the disease as 6 to 12 months and more than 12 months, respectively.

#### VISUAL FUNCTIONS

DVA in the better seeing eye ranged from 1.3 logMAR (6/120) to 0 (6/6). Thirty-one subjects (36 %) had VA of better than 0.3 logMAR (6/12) in the better seeing eye. Fifty subjects (58%) had mild to moderate impairment in which the BCDVA in the better seeing eye was 0.3 logMAR to better than 1 logMAR (6/12 to 6/36). Only 5 subjects (6%) had severe visual impairment in which BCDVA in the better seeing eye was 1 or worse (6/60 or worse). NVA as measured with Malay related-word reading chart in better seeing eye ranged from 1.3 (N40) to 0 (N1) whereas, contrast sensitivity ranged from 0.3 log CS to 1.65 log CS. Reading speed was measured in 59 subjects (68.60%) only as the other 37 subjects (43.02%) were not able to read Bahasa Malaysia fluently. The reading speed measured ranged from 52 to 212 words per minute.

#### NEI-VFQ SCORE

The mean (m) NEI-VFQ composite score was  $66.91 \pm 13.07$ . The most affected subscales were driving ( $m=59.25 \pm 28.86$ ), mental health ( $m=59.28 \pm 16.96$ ), role difficulties ( $m=57.42 \pm 18.72$ ), dependency ( $m=66.57 \pm 20.20$ ) and near activities ( $m=68.59 \pm 16.53$ ). However, peripheral vision ( $m=79.94 \pm 19.86$ ), and colour vision ( $m=89.07 \pm 20.74$ ) were not much affected by the disease. NEI-VFQ score in different domains are shown in Table 1.

#### ASSOCIATION WITH DEMOGRAPHIC CHARACTERISTICS

None of the demographic characteristics including age, gender, race, months of suffering and number of injections showed a significant correlation with NEI-VFQ CS ( $p > .05$ ). However, when subjects with 3 or less injections were compared with subjects with 4 or more injections, subjects with 3 or less injections showed a significantly lower NEI-VFQ score. It was also noticed that subjects suffering some form of visual difficulties for less than 6 months had a significantly lower NE-VFQ CS compared to subjects who reported months of suffering as 6 or more months. Although, Indians showed a comparatively lower QOL score, no significant difference in NEI-VFQ CS were observed between the three races. Similarly, there was no statistically significant difference found in NEI-VFQ CS between typical n-AMD and PCV groups. The mean NEI-VFQ scores between different sub groups are shown in Table 2.

TABLE 1. Descriptive statistics of NEI-VFQ ( $n=86$ )

Domains	Mean $\pm$ SD	Minimum score	Maximum score
NEI-VFQ CS	66.91 $\pm$ 13.07	28.33	92.20
General health	58.14 $\pm$ 18.96	0.00	100.00
General vision	55.58 $\pm$ 20.67	20.00	100.00
Ocular pain	55.14 $\pm$ 16.45	0.00	100.00
Distance activity	68.86 $\pm$ 16.98	16.67	100.00
Near activity	68.59 $\pm$ 16.53	25.00	100.00
Driving*	59.25 $\pm$ 28.86	0.00	91.67
Colour vision	89.07 $\pm$ 20.74	10.00	100.00
Peripheral vision	79.94 $\pm$ 19.86	25.00	100.00
Mental health	59.28 $\pm$ 16.96	18.75	93.75
Social Functioning	75.74 $\pm$ 20.04	25.00	100.00
Role difficulties	57.42 $\pm$ 18.72	25.00	100.00
Dependency	66.57 $\pm$ 20.20	16.67	100.00

\* $n=50$ ; mean  $\pm$  Standard Deviation (SD)

TABLE 2. Effects of race, number of injection and years of suffering on NEI-VFQ CS among Neovascular AMD patients ( $n=86$ )

Variables	Mean $\pm$ SD	F / T	<i>p</i> -value
Race			
Malay	67.69 $\pm$ 15.75	F=1.043 (2)	0.357
Chinese	68.43 $\pm$ 11.56		
Indian	63.58 $\pm$ 11.98		
Type of n-AMD			
Typical n-AMD ( $n=35$ )	63.80 $\pm$ 14.20	T= -2.047 (84)	0.073
PCV ( $n=51$ )	68.89 $\pm$ 11.86		
Number of injections			
0 to 3 ( $n=57$ )	64.73 $\pm$ 13.19	T= -2.219 (84)	0.029
4 & above ( $n=29$ )	71.20 $\pm$ 11.93		
Months of suffering			
< 6 months ( $n=30$ )	62.31 $\pm$ 14.24	F=3.414 (2)	0.038
6 - 12 months ( $n=21$ )	71.33 $\pm$ 8.26		
> 12 months ( $n=35$ )	68.19 $\pm$ 13.48		

mean  $\pm$  Standard Deviation (SD)

#### ASSOCIATION WITH VISUAL FUNCTIONS

NEI-VFQ CS showed a significant association (Table 3) with RS ( $\rho=0.627$ ), CS ( $\rho=0.515$ ), NVA ( $\rho=-0.660$ ), BCDVA ( $\rho=-0.586$ ). When adjusted for age, race, gender and number of anti-VEGF injections, this correlation remained (BCDVA correlation coefficient ( $\rho$ ) = -0.559, NVA= -0.636, CS= 0.517, RS= 0.590).

Furthermore, a multiple regression model was set with BCDVA, NVA and CS as the predictors. To meet the assumptions of multiple regression analysis, severe visual impairment, i.e., BCDVA in better eye worse than 1 log MAR and/or NVA worse than 1 logMAR and/or CS worse than 0.6 log CS, (detected as outliers) were excluded from the model. This model showed that a combination of these three visual functions can be accountable for a significant 38% of variance in NEI-VFQ CS,  $R^2=0.382$ , adjusted  $R^2=0.357$ ,

TABLE 3. Correlation between the NEI-VFQ and the visual functions

Visual functions	Correlation coefficient ( $\rho$ )	<i>p</i> -value
BCDVA <sup>a</sup>	-0.586	0.00
NVA <sup>a</sup>	-0.660	0.00
CS <sup>a</sup>	0.515	0.00
RS <sup>a</sup> ( $n=59$ )	0.627	0.00

<sup>a</sup>Spearman's rho correlation

F (3, 78) = 15.255,  $p=0.00$ . However, when assessing the role of each predictor in the model, it is noted that only NVA is a significant predictor of NEI-VFQ CS (Table 4).

TABLE 4. Unstandardized and standardized regression coefficient for regression model

Visual Functions	B (95% CI) Beta	p-value
BCDVA	-5.223 -0.586	0.506
NVA	-27.650 -0.494	0.001
CS	3.802 0.074	0.524

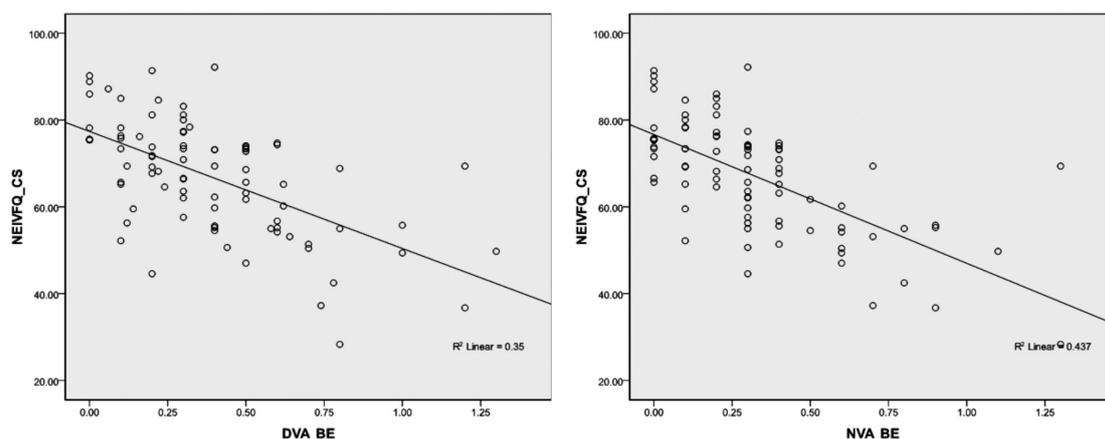


FIGURE 1. Correlation of NEIVFQ CS with BCDVA (A) and NVA (B)

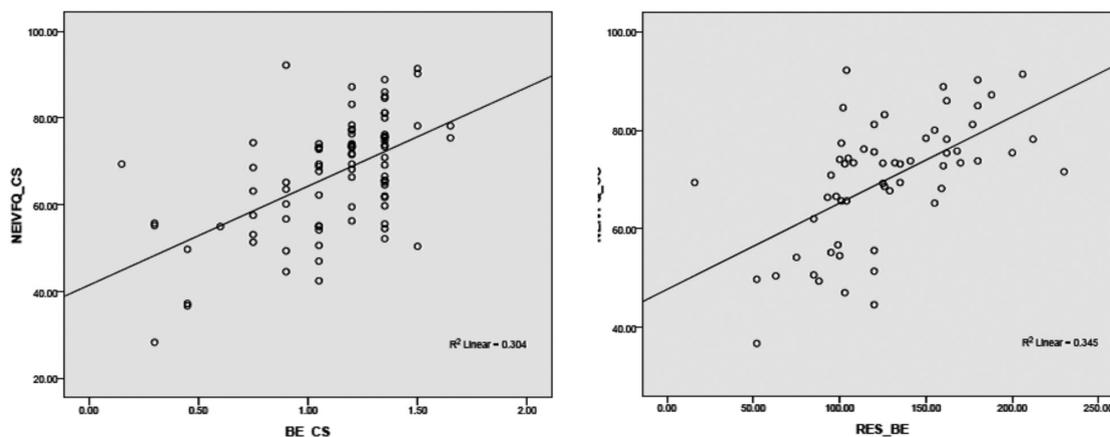


FIGURE 2. Correlation of NEIVFQ CS with CS (A) and RS (B)

## DISCUSSION

Previous researches established that impact of AMD on QOL is as fatal as some of the serious health diseases like cancer and stroke (Brown et al. 2005). However, the impact may vary based on several factors including demographics, visual status, family and social support (Fenwick et al. 2017; Hassell et al. 2006; Matamoros et al. 2015; Sahel et al. 2007). This paper is the first to report QOL in n-AMD patients undergoing anti-VEGF treatment in a public hospital in Malaysia.

In the present study, subjects with n-AMD showed a mean NEI-VFQ CS of 66.9 which is better when compared to some of the previous researches. Matamoros et al. (2015) reported a mean NEI-VFQ CS of 53.4 in 416 patients suffering

from active exudates AMD. Another research by Sahel et al. (2007) reported a mean NEI-VFQ CS of 52.6 in 360 patients with wet AMD. The difference between the results could be because of the difference in the demographic distribution and clinical parameters of the study subjects such as visual impairment status, number of injections and laterality. In the present study, only 6% of the subjects had severe visual impairment whereas 36% of the patients had no visual impairment (BCDVA in better seeing eye is better than 6/12). However, there was some noticeable effect on overall vision targeted QOL score in patients with no visual impairment with an average NEI-VFQ CS score of 73.52. One of the following reasons might be responsible for this finding. Other visual functions such as contrast sensitivity,

near vision and reading speed might have been affected in some of these subjects though they possessed a near normal VA scoring in a high contrast acuity chart that restricted the activities related to fine discrimination. In addition, where the visual functions of the better seeing eye were normal, for example in the eyes without any ocular pathology, visual functions in the worse eye might have had some impact on the individuals' activity. Furthermore, psychological well-being rather than activity limitation might have influenced the overall score in some of these patients. Though none of the NEI-VFQ can be used to directly diagnose anxiety or depression, some of the subscales measure a person's psychological and emotional well-being including mental health, role difficulties, dependency, as well as social functioning that might have been hampered even in mild or no visual impairment. McCloud et al. (2015) reported anxiety concerning injections, new limitations to lifestyle, uncertainty about treatment being some of the concerns of patients with n-AMD undergoing anti-VEGF injections in at least one eye. In some of the recent researches, it has been shown that patients undergoing treatment of n-AMD are at the risk of anxiety, mental stress and depression (Dawson et al. 2014) that might impact the overall QOL score despite having a near normal visual function.

In the present study, there was significant difference observed in mean NEI-VFQ CS between bilateral and unilateral n-AMD with bilateral n-AMD exhibiting 5.95 point low mean NEI-VFQ CS compared with unilateral ones. Besides, 12 subjects undergoing anti-VEGF treatment in both eyes exhibited even lower mean NEI-VFQ CS ( $61.53 \pm 11.56$ ). Our result is supported by the recent study of Paulus et al. (2017) who have noted significant impact on QOL when the fellow eye is affected with n-AMD. Another study by Soubrane et al. (2007) reported significantly lower NEI-VFQ score in bilateral AMD compared to normal subjects.

The most affected domains of life in the present study were driving, mental health, role difficulties whereas peripheral vision and colour vision were some of the aspects which remained unaffected or less affected. These findings are supported by previous literature (Hassell et al. 2006; Matamoros et al. 2015).

PCV is one of the variant of Asian n-AMD (Nazima et al. 2016). However, there are limited literatures on QOL in PCV patients. A recent study found that both typical AMD and PCV had a detrimental impact on patients QOL using the Impact of Visual Impairment (IVI) scale. However, there was no significant difference found between these two groups (Fenwick et al. 2017a). Similarly, the present study comprising 59% of the subjects with PCV in at least one eye showed no significant difference in QOL score between PCV and typical wet AMD patients. This indicates that although treatment pattern varies between two sub groups of wet AMD, overall impact of the disease on patients may be similar.

The present study shows that visual functions including near visual acuity, reading speed, distance visual acuity and contrast sensitivity had significantly

strong correlation with NEI-VFQ CS. When adjusted for the demographic factors, these correlations remained. Although reading speed showed strong correlation with NEI-VFQ CS, it could not be included into the regression model due to small sample size. Therefore, a linear model showed combination of BCDVA, NVA, CS is accounted for a significant 38% variability of NEI-VFQ CS. Furthermore, the regression model showed NVA to be a significant predictor of QOL score in subjects with a VA range of 6/6 to 6/60 in the better seeing eye. This indicates that testing visual functions including near vision, reading speed and contrast sensitivity should be considered as these visual functions are associated with the visual difficulties encountered by n-AMD patients and they explain the impact of n-AMD on quality of life of the affected individuals. Thus, the present study reemphasises the fact that these additional visual functions should be included while assessing treatment and rehabilitation outcome of n-AMD patients (Sabour-Pickett et al. 2013).

Although neither duration of disease nor number of injections had demonstrated a significant correlation with NEI-VFQ CS, but subjects suffering with AMD for less than 6 months showed a significantly lower NEI-VFQ CS compared with those suffering the disease for 6 or more months. Probably, adaptation to the disease course and decrease level of uncertainty with time improves the overall score QOL. Similarly, when comparing NEI-VFQ CS between 3 or less injections and more than 4 injections group, the overall score was better in the second group. Again this could indicate that when the patient understands the process of treatment, it may help them to adapt with the condition. Similar concepts of understanding the treatment pattern by patients undergoing anti-VEGF treatment were discussed by McCloud et al. (2015).

A recent study, which included Chinese, Malay and Indians residing in Singapore concluded that early and late AMD affected vision specific function (VSF) of only Chinese patients whereas VSF in Malay were affected only in late AMD and VSF of Indian patients were not affected by any form of AMD (Fenwick et al. 2017b). However, in the present study, though Indians exhibited an overall lower NEI-VFQ CS score compared with Chinese and Malay, there was no significant difference between them. Dissimilarity between results of these two studies indicates the need of separate data base for each population. On the other hand, NEI-VFQ used in the present study address many domains of life, some of them being psychological, social well-being whereas visual function index-11 measures only visual functions. Activities that do not require fine discrimination can be performed in mild to moderate visual damage. Thus, in individuals where activities that require fine discrimination such as reading, fixing things at home are not priorities on a regular basis, overall vision related functioning may not be hampered, however, in these patients, other domains of life including mental health, role difficulties and social functioning may get affected by the disease reducing the overall vision targeted quality of life. Thus, in present study, subjects without any visual

impairment (BCDVA 6/12 or better in better seeing eye) also showed some impact on NEI-VFQ CS. In short, visual need is one of the major factors in VSF but vision targeted QOL is not only dependant on visual need. This fact also might have some role in the discrepancies between two study results.

Furthermore, socio economic status, standard of living, facilities availed from government, social and cultural background that may vary across the races between countries may contribute to the difference in the impact of the disease on QOL. However, these factors were not assessed in the present study. This can be considered as one of the limitations of the study. In addition to it, increasing sample size while comparing three ethnic groups may provide better understanding and may further strengthen our findings.

#### CONCLUSION

Both typical n-AMD and PCV patients seen in a public hospital in Malaysia exhibited a low NEI-VFQ score irrespective of their racial status. Various domains of life such as driving, mental health, role difficulties and near activities were affected in these patients. However, patients who have had undergone 4 or more injections or have had the disease for a duration of 6 or more months had shown comparatively better NEI-VFQ CS. Thus an early diagnosis and treatment might help the affected individual to cope with the disease process. Furthermore, visual functions in the better eye including BCDVA, NVA, CS and RS were significantly related to NEI-VFQ CS. A combination of BCVA, NVA and CS of the better eye have shown the efficiency to explain a significant 38% variation in NEI-VFQ CS in n-AMD patients with VA range of 6/6 to 6/60 in the better seeing eye. Thus, we suggest incorporating appropriate visual functions such as near acuity, contrast sensitivity and reading speed and QOL assessment in clinical settings while measuring disease impact, treatment and rehabilitation outcomes. Furthermore, developing necessary management strategies comprising counselling, peer group support, low vision rehabilitation services, should be considered to address this QOL issues in n-AMD patients.

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