University of South-Eastern Norway
Faculty of Health and Social Sciences

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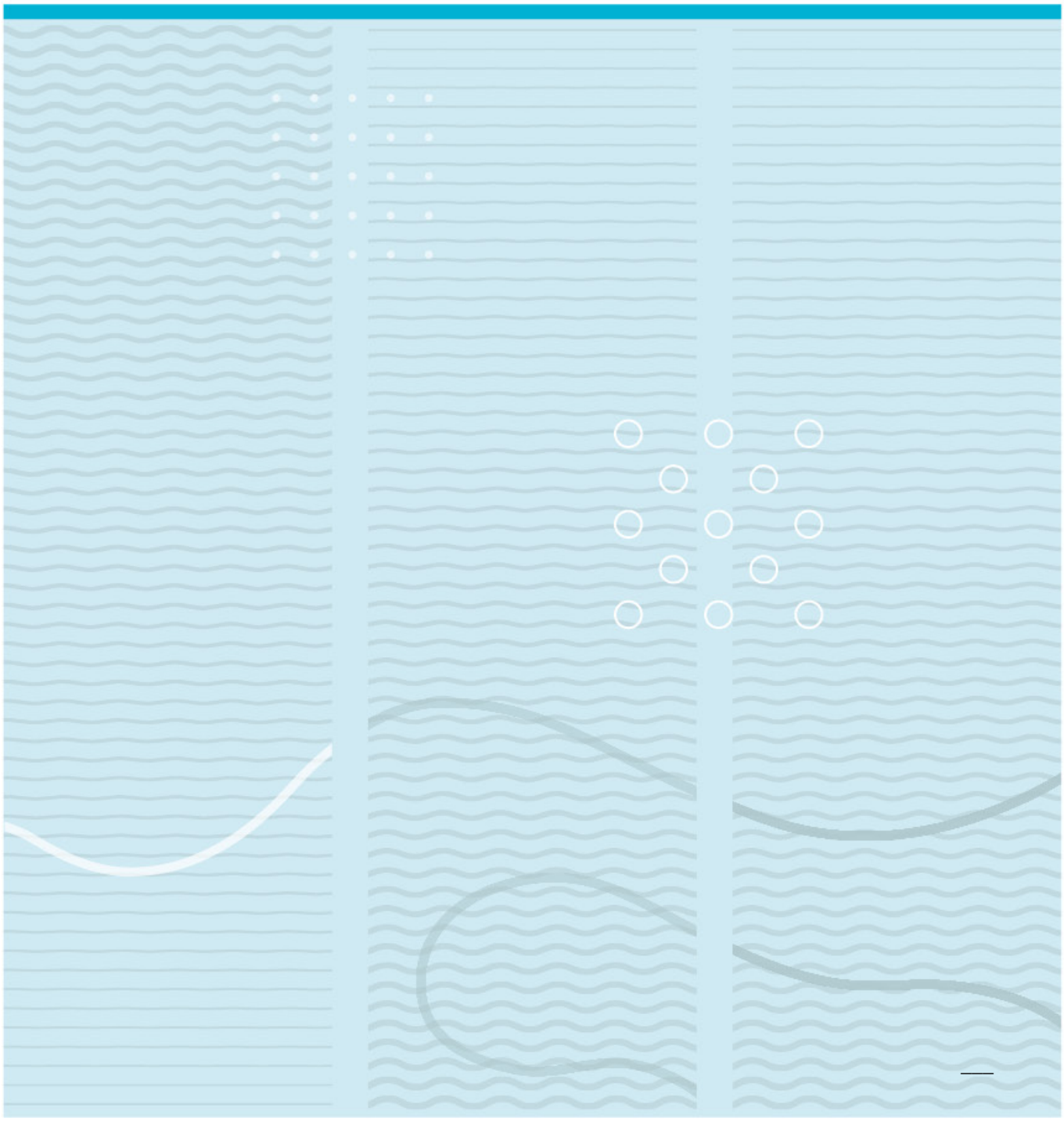
Hanne Tangen Rørdal

Refractive error, ocular disease and visual quality of life in people aged 45 years or older examined in a Norwegian optometric practice



University of South-Eastern Norway
Faculty of Health and Social Sciences
Institute of Optometry, Radiography and Lighting Design
PO Box 235
NO-3603 Kongsberg, Norway

http://www.usn.no

This thesis is worth 30 study points

Summary

The aim of this study is to explore visual function, refractive errors, cataract, age related macular degeneration (AMD), glaucoma, diabetic retinopathy and their association with visual quality of life (VQoL) among adults 45 years or older, in a Norwegian optometric practice. In doing so, we invited all customers who were 45 years or older, who booked an appointment at Specsavers Haugesund to participate in the study. From January to November 2019, 336 volunteered to participate in the study. All participants underwent a standard visual examination the according to the clinical guidelines of The Norwegian association of Optometry and answered the National Eye Institute Visual Function Questionnaire 25 item (NEI VFQ-25) questionnaire. Data from 293 participants was eligible for analysis, 197 (58.6%) females and 139 (41.4%) males. Participants were divided in two age groups: younger adults consisting of participants aged 45-65 years and older adults aged 66 years and older. The results showed a significant improvement in visual acuity (VA), two lines or more, among 14.3% of the participants. Overall, the participants had good visual function, however, a large group of participants had reduced best corrected visual acuity (BCVA). Reduced vision ($0.5 \leq$ BCVA < 0.8) was found for 19.7% of participants and 3.8 % were visual impaired (VA < 0.5) with best correction. The mean (SD) spherical equivalent refractive error (SER) was +0.25D (±1.74), there was no statistically significant difference between the age groups. There were clinical findings of significant cataract among 19.1%, 17.9% of the participants with diabetes had diabetic retinopathy, 5.5% had suspect AMD and 3.75% had suspected glaucoma. Previously unknown ocular disease was disclosed in 24.9% of the participants. The overall mean score for the NEI-VFQ 25 questionnaire for all participants was 87 (±9). Participants with suspected AMD had a significantly poorer score in the NEI VFQ- 25 subcategory distance activities compared to people without ocular disease. The study also found a significantly better score for the sub scores distance activities and peripheral vision in our glaucoma suspect participants compared to the healthy group. Older age was statistically significantly associated with lower score for general health and driving. There was no difference in VQoL in participants with reduced vision, cataracts and diabetic retinopathy compared to the group without ocular disease. To conclude, this study found that 1 of 7 improved their VA with two lines or more with refraction and in 1 of 4 cases there was a disclosure of previously unknown eye disease. In this study, we did not find that reduced vision was associated with VQoL, however higher age, AMD and glaucoma influenced the VQoL score. Therefore, optometrists have an important role in the healthcare system as visual examinations reveals uncorrected refractive errors and can prevent unnecessarily reduced vision because of ocular disease.

Contents

Foreword

First, I would like to thank my colleagues, Specsavers Haugesund and all their customers who participated in the study. Without them, this study would not have been possible. Irene, thanks for being a good listener and supporter. Thank you to my supervisors Vibeke Sundling and Helle Kristine Falkenberg. Vibeke, without you and Siv this project would not have been a finished project. I would also like to take the opportunity to say thanks to all my friends and family who have been there and supported me for the last four years, no matter how busy I have been. A special thanks to Haavard for being there for me.

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Hanne Tangen Rørdal

1 Introduction

One of the optometrists' daily tasks is to understand what each patient does in a day and find the optimal correction accordingly (Sundling, Stene, Eide, & Hugaas Ofstad, 2019). With a constantly more visually demanding world, and the increasing global age, visual quality of life (VQoL) will have a large impact in the future (Jakobsen, 2011; Tsai et al., 2003). In Norway there has been a rising number of older people, this is expected to further increase towards 2040, especially for the group over 80 years (Christiansen Solveig Tobie Glestad, Kravdal Øystein, & Bævre, 2014; Folkehelseinstituttet, 2014). With increasing age, the occurrence of diseases increases, so does ocular diseases (Skau & Norsk oftalmologisk, 2012). We can therefore expect a higher prevalence of people with reduced vision in the future. It is common to define older people as people over the age of 65, although it is debated to move this towards 70 years (Lein, 2015). In Norway, the institute of public health often define elderly as people over 65, this is also comparable to the routine call back in the Norwegian Optometry association (Folkehelseinstituttet, 2014; Norges Optikerforbund, 2008). Today, glaucoma has a prevalence of 2-3% of people over 40 years old, among the older people this number is much higher (Fong & Lee, 2009). Age related macular degeneration (AMD) is more common among Europeans with a prevalence of 12.3%, the prevalence increases from the age of 60 (Wong et al., 2014). One of five aged 65-74 years have cataracts, while four of five get cataract by the age of 85. (Fong & Lee, 2009). Diabetic retinopathy has a global prevalence of 24-36%, in Norway it is slightly lower at 13-24% (Sundling, 2013).

A study conducted by Sundling among Norwegian 65- year-olds showed a good mean best corrected visual acuity (BCVA>1.0), however 5% were visually impaired (VA<0.5) with their presenting optical correction. Among the participants, 47% were hyperopic, 30% emmetropic and 23% myopic (Sundling, 2011). Attebo et al found a similar proportion of uncorrected refractive error, but different distribution of refractive error; 57% hyperopia, 28% emmetropia and 15% myopia. Refraction is expected to change with increasing age, and is one of the most frequent causes of reduced vision (Attebo, Ivers, & Mitchell, 1999).

VQoL is a term used to explain how vision affects daily activities. It is measured with questionnaires based on how the individual feel vision impacts their daily life. There are several questionnaires used. Among these are the National Eye Institute Visual Function Questionnaire (NEI VFQ) and the shorter

version National Eye Institute Visual Function Questionnaire 25 item (NEI VFQ-25) (Mangione et al., 2001; RAND Health Care, 2017) . NEI VFQ was developed to look at the influence of visual impairment on Health-Related Quality Of Life (HRQOL). Research has shown that the NEI VFQ and NEI VFQ-25 are reliable questionnaires in relations to cataracts, age-related macular degeneration (AMD), open-angle glaucoma and diabetic retinopathy (Mangione et al., 2001). By investigating VQoL in addition to clinical investigation you get further understanding of how visual function influence the daily life (Chia, Mitchell, Ojaimi, Rochtchina, & Wang, 2006). Refractive errors cause a reduction in VQoL, although the main reason for reduced VQoL is non-correctable visual impairment (Chia et al., 2006). Research often looks at how the visual impaired (VA <0.5) deal with daily struggles, but less focus is put on those with reduced vision (Chia et al., 2006; Mangione et al., 2001; Marina Trento et al., 2013; Tsai et al., 2003).

It is general knowledge that reduced vision has an impact on VQoL. Reduced vision and eye diseases affect VQoL differently, based on condition and severity of the condition. Reduced distance vision has a higher impact on VQoL than reduced near vision (du Toit, Palagyi, Ramke, Brian, & Lamoureux, 2010). Presbyopia have the same impact on quality of life independently from how presbyopic the individual is (Luo, Brown, Luo, & Brown, 2008). The Blue Mountains Eye study found that correctable refractive errors was a considerable issue among people over 50 years old. However, correctable reduced vision had less impact on VQoL than non-correctable reduced vision (Chia et al., 2006). Moreover, ocular diseases seem to affect visual quality differently based on which part of retina that is affected (Mangione et al., 2001). Blumberg et al found that glaucoma patients with macular defects were more negativity affected than patients with no macular damage (Blumberg et al., 2017). AMD have a negative impact on reading and daily activities. Suffering persons are therefore more prone to isolation, falling and depression (Hassell, Lamoureux, & Keeffe, 2006). Further, cataract impact VQoL differently based on sociodemographic status and where people are in life (Chatziralli, Sergentanis, Peponis, Papazisis, & Moschos, 2013). Because of this working people are more prone to be affected than retired people, probably because people who do not work more easily can adapt other routines. However, there has been shown to be a high occurrence of depressive syndrome and general health issues among elders who have reduced vision, waiting for cataract surgery (Chatziralli et al., 2013; Palagyi et al., 2016; van Nispen, Vreeken, Comijs, Deeg, & van Rens, 2016). In people with diabetes, people with visual impairment due to diabetic retinopathy have lower VQoL at all distances. The more severely affected you are by

diabetic retinopathy, the poorer VQoL score is expected. This applies to both diabetes type 1 and 2 (M. Trento et al., 2013).

Optometrist can therefore play a large role in helping people increase their quality of life through optimal vision correction and vision rehabilitation. By regular eye examinations, optometrist can detect ocular diseases at an early stage, which can minimize the damage and effect on vision and limit the impact on VQoL.

The studies previously presented looked at participants older than 50 years. By excluding the younger participants, you exclude the early presbyopic group. Therefore, by including participants from the age of 45 years, the study would get a perspective on how the reduced vision affect people from an early onset. In the World Health Survey, Norwegians reported a low prevalence of distance visual difficulties, respectively 5,7%, this low number may be related to access to affordable eye care and health services (Freeman et al., 2013). But with a constant elderly population will we be able to keep the welfare system the way as we know it? Can the welfare state, in the future, examine and treat all elderly for eye diseases?

To the best of our knowledge there are no studies on the impact of reduced vision ($0.5 \leq$ BCVA <0.8) on VQoL. Reduced vision affects almost all elderly and impacts their general health. If we can increase our knowledge about how VQoL is affected at different ages and by different eye conditions, optometrists can be more prepared to help individuals with their daily struggles. This may have a large socio-economic effect at a low cost.

2 Aims and research questions

The main aim of this study was to explore visual function, refractive error, cataract, age-related macular degeneration (AMD), glaucoma, diabetic retinopathy and their association with visual quality of life among adults 45 years or older examined in an optometric practice.

The main aim is based on the following research questions:

1. What is the status of refractive errors and visual function among adults 45 years or older seen for a visual examination in optometric practice?

2. What is the frequency of AMD, cataract, glaucoma and diabetic retinopathy among adults seen for an eye exam in optometric practice?

3. How are visual function associated with Visual Quality of Life?

4. How are AMD, cataract, glaucoma and diabetic retinopathy associated with Visual Quality of Life?

This study is important because it will improve our understanding of the visual function and VQoL among people aged 45 years or older. It will provide more knowledge about the association between reduced vision because of refractive errors and ocular diseases and VQoL. The knowledge from this study can have an impact on how optometrists can work to help people stay in work longer and on how we can work interdisciplinary with other health professionals to make elderly function more independently.

3 Methods

3.1 Study design

The study had a descriptive, cross-sectional design.

3.2 Subjects and recruitment

The study population was all men and women aged 45 years or older, attending Specsavers Haugesund for a visual examination in the period January- November 2019

Patients aged 45 years or older, who booked an appointment at Specsavers Haugesund for a full eye examination and were capable of making voluntary, informed consent and able to understand the Norwegian version of NEI VFQ-25 (appendix 2), were invited to participate in the study. The recruitment was conducted by an optical assistant to avoid feeling of pressure to participate in the study. Patients were invited to participate before or after completion of the visual examination. Oral and written information about the study were given by the optical assistant and the participants gave written consent (appendix 1). If the patients had questions, they were answered by the optical assistant or by the project optometrist (HT. R).

The study sample consisted of 336 participants, 197 (58.6%) females and 139 (41.4%) males, who attended a visual examination with the project optometrist at Specsavers Haugesund from January to November 2019. Forty- three (12.8%) participants, were excluded from the analyses in the study due to missing data in the questionnaire or on habitual binocular visual acuity. In the analysis, we divided the participants in to two age groups: younger adults and older adults. Younger adults consisted of participants aged 45-65 years and older adults' people older than 65 years.

3.3 Data collection and equipment

All participantshad underwent a standard optometric examination according to the clinical guidelines of The Norwegian association of Optometry (Norges Optikerforbund, 2005a) and answered the Norwegian version of NEI- VFQ25 questionnaire (appendix 2). Based on the examination, the project optometrist evaluated if further testing was necessary (e.g. visual field examination, optical coherence tomography (OCT), use of diagnostic drugs, need for referral etc.) (Norges Optikerforbund, 2005a). The distance logarithmic visual acuity chart "ETDRS", chart "R" with notation for 4m were used to measure distance visual acuity. The logarithmic near vision chart "1" from Good-Lite was used for testing at 40 cm. If the patient was new to the practice, habitual correction was measured using focimeter (NIDEK LM1000P Auto Lensmeeter and the Topcon CL-100 Computerized Lensmeeter). The pretest room had a combined Fundus imaging and OCT, NIDEK RS-330. The autorefractor, tonometer and keratometer was a NIDEK RKT-7700. For visual field screening the Octopus 900 was used. Fundus photos, intra ocular pressure (IOP)- and OCT measurements and perimetry testing was conducted by optical assistants and the results evaluated by the project optometrist. The visual examination lasted 30 minutes. Additionally, fundus photography and IOP-measurement took about 5 minutes. If there was a need for additional tests (OCT, perimetry), longer time was expected. The NEI VFQ-25 questionnaire took 5-10 minutes to complete. The visual examination and NEI VFQ-25 questionnaire are described detail in section 3.4 and 3.5.

3.4 Visual examination

Information about general health (type of diabetes, hypertension and cardiovascular disease), visits to ophthalmologist (visit frequency), cataract and refractive surgery, known retinopathy, glaucoma, diabetic retinopathy, AMD and cataract was based on patient report and not verified. Visual acuity (VA) with habitual corrections or no correction in cases where there was no habitual correction, was measured at distance, with logarithmic visual acuity chart "ETDRS", chart "R" with notation for 4m. It was registered as logMAR visual acuity in 0.02 steps monocularly and binocularly. If the patient used distance correction for only specific tasks as television or driving, unaided visual acuity was recorded monocularly and binocularly. If the patient had lost his/her glasses, unaided visual acuity was recorded, unless they wore old glasses, then habitual visual acuity with old glasses were

recorded. Refraction was based on retinoscopy results. Subjective measurements were conducted in phoropter, followed by binocular balancing with prism-dissociated blur (Elliott, 2008, pp. 75-88, 91-94). Near addition and VA was measured at 40cm in the trial frame with the logarithmic near vision chart "1" from Good-Lite, and recorded binocular and monocular with 0.02 decimals for each eye. In cases where the patient needed a shorter reading distance, both reading distances was recorded in the journal, but only the visual acuity at 40cm was transferred and used for analysis in this study. Contrast sensitivity was measured at 1m distance, with best corrected visual acuity at distance in trial frame, at the end of the eye examination. Measurements where conducted with the Pelli-Robson distance chart and recorded for each eye and binocular with 0.05 decimals(Elliott, 2008, pp. 58-61).

Van Herick´s method was used to evaluate temporal anterior chamber angle and recorded on an ordinal scale from 0-4 in whole numbers for each eye (Elliott, 2008, pp. 229-231). Evaluation of the crystalline was based on LOCS III (Chylack et al., 1993). Nuclear colour and opacity, cortical cataracts and posterior subcapsular cataracts was recorded on a scale from 0-6 in 0,5 steps for each eye. It was noted if the patient has had cataract surgery and if there was any posterior capsulate opacification, this was noted as a yes or no. Posterior segment (vitreous, Cup/Disk ratio (C/D), ISNT rule, pigmentations, fundus colour, arteries/Vein (A/V) ratio, bleedings or degenerations) was evaluated with slit-lamp and Volk 90D super field lens. Dilated fundus examination was performed with Tropicamide minims 0,5%, if undilated examination gave inadequate view of the posterior pole because of small pupils and/or cataract. It was not recorded for this study when diagnostic drugs were used, as this was outside the scope of the study.

Intra ocular pressure (IOP) was measured by trained personal with Nidek RKT-7700, and the readings evaluated by the project optometrist. If the IOP was greater than or equal to 21 mmHg, or there was a 4mmHg difference between the eyes, further tests were evaluated. Based on guideline number one from the Norwegian Association of Optometry and the NICE guideline 81(NICE National Institute for Health and Care Excellence, 2017; Norges Optikerforbund, 2005a, 2005b), higher IOP, optic nerve damage or change (large C/D ratio, change in C/D ratio, lamina cribrosa, notching, change to the ISNT- rule etc.) will indicate the need for visual field screening by standard automated perimetry (supra-threshold or full threshold) (Elliott, 2008, pp. 257-258, 282-286; Johannessen, 2019; NICE National Institute for Health and Care Excellence, 2017; Norges

Optikerforbund, 2005a, 2005b). Perimetry was conducted by trained personnel and evaluated by the project optometrist (HT. R) with Octopus 900, G Dynamic program (Standard stimuli white/ white background. Stimulus size III, with cross marks target) and recorded as normal or abnormal (Bowling, Kanski, Nischal, & Pearson, 2016, pp. 323-330; Johannessen, 2019; NICE National Institute for Health and Care Excellence, 2017). The optic nerves were examined with the slit lamp at 10 times magnification. The C/D-ratio was recorded in 0,5 steps on a continuous scale, together with a note whether the ISNT rule where followed or not (Bowling et al., 2016, pp. 316-320; NICE National Institute for Health and Care Excellence, 2017). If the ISNT rule was not obtained, a note was made to the relation of the neuroretinal rim, which should be about 1.5-20 times wider superior-inferior than temporal. It is suspicious of glaucoma if the superior and inferior part becomes thinner and "notch", as it indicates local loss of neural rim (Bowling et al., 2016, p. 316; Elliott, 2008, pp. 257-258).

The macula, central 10 degrees was evaluated in regard to unnormal changes such as drusen, bleedings, exudates, edema and so on with a Volk 90D super field lens. Amsler chart was used to evaluate AMD changes for every patient. In cases where there was a positive response to Amsler, OCT with NIDEK RS-330 (scan: Makula map. Scan setting: A point 512, B point 128. Cross HD count: 5. Scan type: x-y. Regular sensitivity.) was conducted and recorded as normal or abnormal.

In addition to slit lamp examination, fundus photography with Nidek RS-330 was taken by trained personal and evaluated by the project optometrist after the visual examination. The evaluation was divided into three areas for each eye: papillae, macula area and other areas. The papillae were graded as abnormal in cases where there was atrophy, pigmentation, the ISNT-rule was not followed, suspected A/V changes, bleedings or other changes that would normally have been recorded in the patient record. The macular area was graded as abnormal if there were bleedings, drusen, exudates, hypo/ hyper pigmentation, edema or other findings that would make a note in the patient record. Other areas (elsewhere than the papillae and macula) was noted as abnormal in cases with tigroid fundus, pigmentations, nevus, drusen, bleedings or other retinal changes that would require a note in the patient record. When evaluating the findings on papillae, macula or elsewhere, we did not evaluate if changes was age-related or normal variations. In cases where the image quality was poor, the photos where retaken. A colleague was asked to blindly evaluate 30 of the fundus photos (10 with findings on papillae, 10 in macula and 10 in elsewhere) that was taken,

and grade them as normal or abnormal. The project optometrist and the colleague graded all images equal inn all but 3 cases, give a grading correspondence of 83.3%. The colleague optometrist graded two images as abnormal with regard to macula and one image as abnormal with regard to elsewhere, all three were graded normal by the research optometrist.

Based on the visual examination suitable optometric solutions were prescribed, or further testing or referral was made. If any examination needed to be repeated because of poor quality, or supplementary test where required, this was done at the end of the eye examination.

3.5 NEI VFQ-25

In addition to the visual examination the patients completed a questionnaire about their visual function and quality of life. We used the Norwegian version (appendix 2) of the validated NEI VFQ-25 self-administered questionnaire(RAND Health Care, 2017) this based on the NEI-VFQ (51 item) questionnaire(Mangione et al., 2001). The NEI VFQ- 25 manual (appendix 3) were used to calculate the scores (RAND Health Care). This is a stepwise process, first we recode the answered questions. All questions get a score from 0-100, were high scores indicate better results. The score given is a percent of the highest possible value you can obtain. To create a subscale, we average the score on each question. Missing data will not be accounted for, therefore at least one question in each subscale have to be answered to create a subscale. The different subscales are composed of different number of questions. General health is based on question 1, general vision on question 2, ocular pain 4 and 19, near activities: 5,6,7, distance vision; 8,9,14, social functioning 11 and 13, mental health 3, 21,22 and 25, role difficulties 17 and 18, dependency: 20,23 and 24, driving: 15c, 15 and 16 a, colour vision: 12 and peripheral vision compose of question 10. The overall score (VQoL) is made up by averaging all sub scores, except the general health score (RAND Health Care).

3.6 Data analysis and statistics

Data from the visual examination and questionnaire were transferred manually to a database and analysed in Microsoft Excel. The participants were identified in the dataset with an id number. Unrealistic values, or outliers was identified and compared with the collected data. There were five typos, these where corrected. Ungradable data where treated as missing data. Participants who

had not completed the questionnaire or had missing data on habitual binocular visual acuity were excluded from the analysis. Eye diseases was diagnosed on an individual level. Significant cataract was defined as by Tan et al. according to the LOCS III scale, nuclear cataract ≥4, cortical ≥2 and posterior subcapsular cataract ≥2 (Tan et al., 2011). Glaucoma suspected participants was defined based on the NICE guideline algorithm for glaucoma (NICE National Institute for Health and Care Excellence, 2017, p. 12), where visual field, optic nerve changes, IOP, peripheral anterior chamber angle and CCT is taken into account. Based on this we conducted perimetry on indication, and defined participants as glaucoma suspect if the visual field was abnormal on one or both eyes. Diabetic retinopathy was recorded as present or absent for one or both eyes based on fundus examination with Volk 90D and fundus photo, and in people with known diagnosis of diabetes type one or two (Norges Optikerforbund, 2005c). AMD suspected participants was defined based on present positive result on Amsler, AMD related findings in fundus photo (bleedings, drusen, atrophy, hypo/hyperpigmentation etc.) and abnormal OCT findings.

Normal vision was defined as visual acuity ≥ 0.8, as normal age-matched visual acuity for people in aged 45 years and older should be between 0.8-1.4 (Elliott, 2008, p. 34). Reduced vision was defined as visual acuity <0.8. Visual impairment was defined as by Sundling, that is based on the requirement for driving in Norway (Helsedirektoratet, 2016a; Sundling, 2011; Wankel, Bondø, & Jørstad, 2018). Refractive errors was defined by spherical equivalent power (SER): hyperopia ≥ +0.50D, myopia ≤ -0.50 and emmetropia between -0.50D and +0.50D as by Sundling (Sundling, 2011). Clinical significant under-corrected refractive errors was defined as in the Blue Mountain Eye Study (Thiagalingam, Cumming, & Mitchell, 2002), that is a an un- or under-corrected refractive error which improves with 0,2 logMAR units or more after refraction, equivalent to 2 lines, 10 letters on the logMAR chart (Thiagalingam et al., 2002).

Frequency were analysed by the filtration option in Excel. Chi-square (X^2), Fisher exact test (FET) and Student t test was used analyse differences between groups. Data were considered statistically significant with a p value <0.05. Statistically, there was no difference between the right and left eye, therefore only data collected from the right eye was used in the analysis of mean visual functions. For analysing of VQoL binocular measurements were used, and the analysis of vision and ocular disease were done at individual level.

3.7 Ethics

The study was completed according to the Declaration of Helsinki for research involving humans and the act on medical and health research. It was approved by the Regional Committee for medical Research Ethics for the Southern Norway Regional Health Authority (REK), 2018/1029/REK Nord. Participation was voluntary. The patient got oral and written information about the study and signed an informed consent form. It was possible to withdraw consent at all times. Withdrawal did not affect any further management or treatment at Specsavers Haugesund. To ensure anonymity, the data were recorded with an id-number in the dataset. An additional crypted datafile was created with as a key to ensure the patient could be removed from the dataset. The id-key where stored as a password protected file on a computer, the computer was locked in a safe.

The questionnaires with consent forms where stored in the store, inside a locked room. The personal information regarding the visual examination where stored in Optimal 1992-2012. A data file with unique id-number and names was created and saved electronically.

4 Results

4.1 Demographics of the participants

Of the 293 participants who were included in the analysis, 167 (56.9%) were female and 126 (43%) were male. Their mean (sd) age was 62 (±10) years, ranging from 45 to 85 years. The younger adult's group (45-65 years) consisted of a total of 162 (55.3%) participants, with the mean age 55(±6) years. The older adult's group consisted 131 (44.7%) participants over 65 years, with the mean age of 72 (±5) years. There was no significant difference between male and females in the two age groups.

Table 1 shows the diagnoses of general and ocular health for the two age groups. In all, 89 (30.4%) had high blood pressure, 88 (30.0%) had known cardiovascular disease and 28(9.6%) had diabetes. Of the participant who had diabetes, 23 (82.1%) had type 2 diabetes, 3 (10.7%) had diabetes type 1

and 2 (7.1%) did not know which type of diabetes they had. Seven (25%) of the 28 with a diagnosis of diabetes had not been referred to an eye doctor for screening for diabetic retinopathy. Participants in the older age group had significantly higher frequency of cardiovascular disease (X^2 *(1, N= 88, p < .001))* and high blood pressure X^2 *(1, N= 89, p = .009).* In total, 27 (9.2%) participants reported one or more diagnoses of ocular disease, including glaucoma, diabetic retinopathy, cataract or AMD. In all, 16 (5.5%) had known cataract, 4 (1.4%) had known glaucoma, 4 (1.4%) had known AMD, 2 (0.7%) had cataract and glaucoma, there was no significant difference in ocular disease between the two age groups. Of the 28 participants with diabetes, 1 (3.6%) participants had known diabetic retinopathy, there was no statistically significant difference in diabetic retinopathy between age groups. Twenty-eight participants (9.5%) and 6 (2%) had undergone cataract and refractive surgery, respectively. There was a significantly larger number of participants in the older adult group who had had cataract operation X^2 *(1, N= 28, p < .001)* compared to the participants in the younger adult group. There was a significant difference in frequency of refractive surgery (FET *(p = .03))* as only the participants in the younger age group had undergone refractive surgery.

Among the 293 participants, 44 (15.0%) had regular examinations by an ophthalmologist. The mean interval length for follow-ups was 14 months, 2 participants did not know their regular interval length.

Table 1: Participant gender, self-reported general health, ocular health and follow-up with the ophthalmologist by age groups n (%).

		Total (n = 293)		45-65 (n=162)		65+ (n=131)	
Sex		n	%	n	%	n	%
	Female	167	(56.9)	97	(59.9)	70	(53.4)
	Male	126	(43.0)	65	(40.1)	61	(46.6)
Genera health							
	Cardiovascular disease†***	88	(30.0)	31	(19.1)	57	(43.5)
	High blood pressure†**	89	(30.3)	39	(24.1)	50	(38.2)
	Diabetes total	28	(9.6)	18	(11.1)	10	(7.6)
Eye condition							
	Cataract	16	(5.5)	11	(6.8)	5	(3.8)
	Glaucoma	6	(2.0)	3	(1.9)	3	(1.9)
	Diabetic retinopathy	1	(3.6)	0	(0)	1	(10.0)
	AMD	3	(1.0)	2	(1.2)	1	(0.8)
	Cataract surgery†***	28	(9.5)	5	(3.1)	23	(17.6)
	Refractive surgery‡*	6	(2.0)	6	(3.7)	0	(0)
Follow-up with ophthalmologist		44	(15.0)	22	(13.6)	22	(16.8)

Abbreviations: n; number. Statically significant difference between age groups †Chi-square and ‡Fisher exact test: * p<0.05, ** p<0.01 and *** p<0.001.

4.2 Visual function and refractive status

The mean (SD) spherical equivalent refractive error (SER) was +0.25D (±1.74). There was no statistically significant difference in mean SER between the age groups. The majority of participants were hyperopic and there was no statistically significant difference distribution of refractive error between the two age groups, table 2.

Table 2: Refractive status by participant age groups (%).

	Total (n = 293)		45-65 (n=162)		65+ (n=131)	
	n	%	n	%	n	%
Emmetropia	76	(25.9)	42	(25.9)	34	(25.9)
Hyperopia	143	(48.8)	78	(48.2)	65	(49.6)
Myopia	74	(25.3)	42	(25.9)	32	(24.4)

Abbreviations: n; number, VA; visual acuity. SD; standard deviation.

The mean habitual binocular VA for all participants were 0.09 ± 0.17 (equivalent to Snellen acuity 0.8) compared to the binocular best corrected visual acuity (BCVA) that were 0.02 ±0.18 (equivalent to Snellen acuity 1.0). There was a significant improvement in binocular BCVA compared to habitual binocular visual acuity (*t (581) = 1.964, p < .001)*. There was no difference in mean habitual binocular VA and mean binocular BCVA between the two age groups, table 3. In all, 42 (14.3%) participants improved their visual acuity with 2 lines or more with best correction. With their habitual refraction, 96 (32.7%) had reduced vision and 29 (9.9%) were visually impaired. Best corrected, 58 (19.7%) participants had reduced vision (VA < 0.8) and 11 (3.8%) were visual impaired (VA < 0.5). There was no difference between the two age groups regard to reduced vision or visual impairment, table 4.

Table 3: Mean (sd) habitual visual acuity, best corrected visual acuity, near visual acuity and contrast vision by age group.

		All (n= 293)		45-65 years (n= 162)		65+ years (n= 131)	
		Mean	sd	Mean	sd	Mean	sd
Visual acuity							
	HVA OD[1]	0.19	(±0.22)	0.18	(±0.22)	0.20	(±0.22)
	HVA OS	0.19	(±0.22)	0.20	(±0.23)	0.18	(±0.22)
	HVA BIN	0.09	(±0.17)	0.09	(±0.17)	0.10	(±0.17)
	BCVA OD[1]	0.08	(±0.19)	0.07	(±0.15)	0.08	(±0.23)
	BCVA OS	0.08	(±0.20)	0.06	(±0.17)	0.09	(±0.24)
	BCVA BIN	0.02	(±0.18)	0.01	(±0.13)	0.04	(±0.22)
	Near OD[2]	0.07	(±0.16)	0.08	(±0.16)	0.06	(±0.15)
	Near OS[3]	0.06	(±0.15)	0.07	(±0.14)	0.06	(±0.16)
	Near bin[3]**	-0.02	(±0.12)	-0,02	(±0.12)	-0.01	(±0.12)
Contrast Vision							
	OD[4]	1.46	(±0.19)	1.47	(±0.18)	1.60	(±0.11)
	OS[4]	1.47	(±0.18)	1.48	(±0.17)	1.46	(±0.20)
	BIN[4]***	1.60	(±0.11)	1.61	(±0.10)	1.60	(±0.12)

Abbreviations: n; number, sd; standard deviation, HVA; habitual visual acuity, OD; oculus dextrus, OS; Oculus sinister, BIN; binocular, BCVA; best corrected visual acuity. Missing data for [1] 2, [2]8, [3]6, [4]3. Statically significant difference between groups by student t-test * p<0.05, ** p<0.01 and *** p<0.001.

Table 4: BCVA grouped by age groups n (%).

VA	Total (n = 293)		45-65 (n=162)		65+ (n=131)	
	n	%	n	%	n	%
1.0 or better	136	(46.4)	75	(46.3)	61	(46.6)
VA<1.0	88	(30.0)	53	(32.7)	35	(26.7)
VA<0.8	58	(19.8)	30	(18.5)	28	(21.4)
VA<0.5	7	(2.4)	3	(1.9)	4	(3.1)
VA<0.33	4	(1.4)	1	(0.6)	3	(2.3)

Abbreviations: n; number, VA; visual acuity.

Mean binocular near visual acuity (sd) for all participants were -0.02 (±0.12). There was a significant better binocular near VA (-0.02logMAR) compared to binocular BCVA on distance (0.02logMAR) (*t (511) = 1.964, p = .002).* The mean addition was +2.25DS (±0.45), there was no significant difference between the two age groups with regard to addition and near VA.

It was a significant difference between monocular and binocular contrast sensitivity (*t (577) = 1.964, p < .001),* table 3. Contrast sensitivity was lower among the older adults, 1.60 log (±12), compared to the younger adults 1.61 (±10) log, however this difference was not significant.

Central visual field was tested with Amsler chart for 282 (96.3%) participants. In total, 38 (13.4%) had abnormal findings for one or both eyes. Eight participants (2.8%) in right eye, 12 (4.3%) in the left eye and 18 (6.4%) in both eyes.

4.3 Ocular Findings

Among the 293 participants, 205 (70.0%) had normal eye status, 88 (30.0%) had findings of cataract, diabetic retinopathy, suspected AMD or suspected glaucoma, table 5 and 6. Of these 88 participants, 15 (17.0%) knew they had one or more diagnosis of AMD, cataract, retinopathy, glaucoma or diabetic retinopathy, and 13 (14.7%) had regular visits with an ophthalmologist. Therefore, 73 (24.9%) cases disclosed previously unknown ocular disease.

Of the 88 participants with clinical findings, 56 (63.6%) had significant cataract. The mean (SD) binocular habitual visual acuity among participants with significant cataract was 0.15 (±0.1) logMAR (equivalent to Snellen acuity 0.7), improving to BCVA 0.08 (±0.1) (equivalent to Snellen acuity 0.8), this improvement in visual acuity was statistically significant (*t (110) =1.981, p = .01).* Of the 56 (21.1%) participants with findings of cataract, 43 (14.7%) had clinical significant nuclear cataract (clinical significant cortical color/opacity or both(LOCS III ≥4)), 26 (8.9%) had clinically significant cortical cataract (LOCS III ≥2) and 4 (1.2%) had clinical significant posterior subcapsular cataract (LOCS III ≥2), Table 5.

Further, 32 (10.9%) participants were pseudophakic in one or both eyes, of the 32 participants with psaudoafakia 11 (34.4%) had posterior capsular opacification (PCO), table 5. The rate of psaudoafakia was significantly higher among older adults than younger adults (X^2 *(1, N = 32, p = .01)),* table 5.

Table 5: shows the distribution of psaudoafakia and clinically significant cataract by age groups.

	Total (n = 293)		45-65 (n=162)		65+ (n=131)	
	n	%	n	%	n	%
Significant cataract	56	(19.1)	31	(19.1)	25	(19)
Nuclear Opacity ‡**	36	(12.3)	20	(12.3)	16	(12.2)
Nuclear color	41	(14.0)	24	(14.8)	17	(13.0)
Cortical	26	(8.9)	14	(8.6)	12	(9.1)
Posterior Subcapsular	4	(1.4)	6	(3.7)	3	(2.3)
	OD %	OS %	OD %	OS %	OD %	OS %
Cataract operated						
Psaudoafakia †	29 (9.9)	31* (10.6)	11 (6.7)	11 (6.7)	18 (13.7)	20 (15.3)
PCO	8 (27.6)	10 (32.3)	2 (18.2)	5 (45.5)	6 (33.3)	5 (25.0)

Abbreviations: n; number, OD; oculus dextrus, OS; oculus sinister, PCO; posterior capsular opacification. Statically significant difference between VA groups by †Chi/‡student t-test: * p<0.05, ** p<0.01 and *** p<0.001.

Table 6 shows Van Herick evaluation, intra ocular pressure and optic nerve assessment by age groups. There was no statistical difference in Van Herick, IOP, C/D and ISNT between the two age groups. The median value for the Van Herick measurement was 4, ranging from 1 to 4. Mean IOP (sd) was 14.6 (± 3.1) mmHg. Three (1.0%) participants had a difference in mean IOP of 4 or more between the eyes. The ISNT- rule was evaluated in all 293 participants (586 eyes) with Volk 90D, of

these 7 (2.4%) the ISNT-rule was not gradable. For 23 participants (7.8%) the ISNT rule was broken in one or both eyes, 10 (3.4%) right eyes, 3 (1.0%) left eyes and for 17 (5.8%) in both eyes.

Fundus photo was taken for all participants. In all, 246 (83.9%) participants had one or more findings on papillae (atrophy, pigmentation, the ISNT-rule was not followed, suspected A/V changes, bleedings or other changes), macula (bleedings, drusen, exudates, hypo/ hyper pigmentation, edema or other findings) or elsewhere (tigroid fundus, pigmentations, nevus, drusen, bleedings or other retinal changes) in one or both eyes when assessed by fundus photo, table 6. These findings ranged from normal variations, age related changes to findings with need for referral, not explicitly reported.

Five of the 28 participants with known diabetes (17.8%) had diabetic retinopathy, table 7. The mean (SD) binocular habitual visual acuity among participants with diabetic retinopathy was 0.16 (±0.2) logMAR (equivalent to Snellen acuity 0.7), improving to 0.08 (±0.2) (equivalent to Snellen acuity 0.8), this change was not significant. Of the total 293 participants 38 (12.9%) had suspected findings on Amsler chart for one or both eyes, table 7. Sixteen (5.5%) of the 293 participants had findings on Amsler, OCT and fundus photo and therefore suspected AMD. There was a non-significant improvement in BCVA (0.05 logMAR, equivalent to Snellen acuity 0.9) compared to habitual VA (0.12 logMAR, equivalent to Snellen acuity 0.7+) in participants with suspected AMD. Of the 293 participants, 11 (3.75%) had suspected glaucoma in one or both eyes. Of the participants with suspected glaucoma, four had IOP over 24mmHg or had a difference in IOP between the eyes of 4mmHg or more, table 7. There was a non-significant improvement in BCVA (0.09 logMAR, equivalent to Snellen acuity 0.8+) compared to habitual VA participants with suspected glaucoma.

Table 6: shows results on Van Herick, IOP, C/D ratio, ISNT rule assessment for the 293 participants and fundus photo assessment for all 293 participants and for the two age groups.

	Total (n = 293)				45-65 (n=162)				65+ (n=131)			
	Mean	SD	Range	Median	mean	SD	Range	Median	Mean	SD	Range	median
Van Herick temporal OD	3.5	(0.9)	1-4	4	3.5	(0.9)	1-4	4	3.4	(0.9)	1-4	4
IOP OD [1]	14.6	(3.1)	7-26	14	14.5	(3.2)	8-26	7	14.7	(2.8)	7-24	15
C/D vertical OD[1]	0.36	(0.13)	0.1-0.9	0.3	0.36	(0.13)	0.15-0.9	0.3	0.35	(0.13)	0.1-0.8	0.3
	OD		OS		OD		OS		OD		OS	
	n	%	n	%	n	%	n	%	n	%	n	%
ISNT not followed	20[2]	(7.2)	15[3]	(5.2)	12	(7.4)	9	(5.5)	8	(6.1)	6	(4.6)
Fundus photo												
Papillae[4]	191	(68.2)	192	(68.6)	100	(61.7)	107	(66.0)	91	(69.5)	85	(64.9)
Macula	95[5]	(37.7)	88[6]	(36.8)	56	(34.6)	46	(28.3)	39	(29.7)	42	(32.0)
Elsewhere	106[7]	(40.6)	87[8]	(34.7)	60	(37.0)	43	(26.5)	46	(35.1)	44	(33.6)

Abbreviations: n; number, SD; standard deviation, OD; oculus dextrus, OS; oculus sinister, IOP; intraocular pressure, C/D; Cup/disc ratio, ISNT; Inferior>Superior>Nasal>Temporal. *Missing values: [1]8, [2]15,[3]7,*[4]13,[5]41,[6]54,[7]32, [8]42.

Table 7: shows the distribution of diabetic retinopathy, suspected AMD and suspected glaucoma by age groups, n (%).

	Total (n = 293)		45-65 (n=162)		65+ (n=131)	
	n	%	n	%	n	%
Diabetic retinopathy	5	(17.9)	5	(27.7)	0	(0)
AMD findings OU †*	38	(13.0)	27	(16.6)	11	(8.4)
Positive Amsler†*	38[1]	(13.0)	27	(16.6)	11	(8.4)
AMD findings on photo	12[2]	(4.1)	7	(4.3)	5	(3.8)
AMD finding on OCT	12[3]	(4.1)	10	(6.7)	10	(7.6)
Glaucoma suspected findings	30	(10.2)	20	(12.3)	10	(7.6)
IOP	4	(1.4)	2	(1.2)	2	(1.5)
ISNT	23	(7.8)	14	(8.6)	9	(6.9)
Visual field‡**	11	(3.8)	9	(5.5)	2	(1.5)

AMD; Age related Macular Degeneration, OCT; Optical Coherence Tomography, IOP; Intra Ocular Preassure, ISNT; Inferior>Superior>Nasal>Temporal. Missing values for: [1]12, [2]17, [3]10. Statically significant difference between age groups †Chi-square/‡Fisher: * p <.05, ** p <.01 and *** p <.001.

4.4 Visual Quality of Life

The mean total score for the NEI-VFQ 25 questionnaire was 87 (±9). Overall, general health had lowest mean score of the NEI-VFQ-25 subscales. The means in the two age groups were similar, respectively 88 (±9) for the group aged 45-65 years and 87 (±8) for the group over 65 years of age, table 8. There was a significant poorer score for the sub score general health (*t (291) = 1.969, p = .007)* and driving (*t (277) = 1.969, p = .03)* among older adults compared to the younger adults, table 8.

There was no statistically significant difference in the mean score between participants with normal vision and reduced vision, table 9. There was a significant poorer score for the subcategory distance activities among participants had suspected AMD compared to the group with no ocular disease *(t (228) =-2.206, p=.03)), table 9.* Participants with suspected glaucoma had a significantly better subscore in regard to distance activities than the group with no eye conditions *(t (12) = 2.188, p= .05))* and peripheral vision *(t (13) =2.244, p=.04),* table 9. The suspected glaucoma participants were 57 years old. There was no significant difference in overall mean score or subscale scores for participants with cataract and diabetic retinopathy compared to participants without any ocular disease, table 9.

Table 8: Mean (sd) score for VQoL subscales by age groups.

	Total (n = 293)		45-65 (n=162)		65+ (n=131)	
	Mean	sd	Mean	sd	Mean	sd
VQoL	87	(9)	88	(9)	87	(8)
General health**	63	(22)	66	(23)	59	(19)
General vision	76	(13)	76	(14)	77	(12)
Ocular pain	86	(16)	87	(17)	84	(16)
Near activities	81	(16)	79	(18)	82	(15)
Distance activities	87	(13)	88	(12)	87	(13)
Social functioning	95	(10)	96	(9)	94	(10)
Mental health	89	(9)	89	(9)	90	(8)
Role difficulties	85	(17)	84	(17)	86	(16)
Dependency	98	(6)	98	(7)	98	(6)
Driving*	80	(17)	82	(17)	78	(17)
Color vision	96	(12)	97	(11)	94	(13)
Peripheral vision	89	(15)	89	(15)	88	(16)

Abbreviations: n; number, VQoL; Visual Quality of Life, SD; Standard Deviation, VA; Visual Acuity. Statically significant difference younger/ older adults, student-test: * $p<0.05$, ** $p<0.01$ and *** $p<0.001$.

Table 9: Mean values and standard deviation for the VQoL questionnaire for habitual binocular visual acuity groups, participants with cataract, diabetic retinopathy, AMD and glaucoma

	n	VQoL		General Health		General Vision		Ocular pain		Near Activities		Distance activities		Social functioning		Mental health		Role Difficulties		Dependency		Driving		Color Vision		Peripheral vision	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
All	293	87.0	9.0	62.9	21.9	76.5	13.3	85.8	16.2	80.6	16.4	87.2	12.8	94.8	9.6	89.4	8.9	85.2	16.7	97.8	6.4	80.2	17	95.6	11.6	88.7	15.4
Normal vision	224	87.5	8.5	63.4	21.6	76.9	13.4	85.9	16.5	81.0	16.4	87.3	12.4	95.1	9.1	89.5	8.8	85.4	16.4	97.6	6.7	80.1	17.1	95.3	12.1	88.7	15.5
Reduced vision (VA <0.8)	69	87.1	8.8	61.2	22.9	75.1	13.0	85.3	15.6	79.2	16.4	87.1	14.0	93.8	11.1	88.9	9.4	84.4	17.7	98.4	5.2	80.6	16.5	96.4	9.8	88.8	15.2
No eye diagnosis	214	87.2	8.6	62.5	20.9	76.4	13.2	85.7	16.3	80.1	16.0	87.5	12.3	94.5	9.5	89.4	9.1	84.8	16.7	97.3	7.2	79.9	17.2	95.6	11.0	88.2	8.6
Cataract	56	88.0	8.6	65	24.4	77.3	11.9	86.7	16.3	81.8	17.6	85.8	13.7	95.0	10.6	89.5	8.3	86.7	17.4	99.2	2.5	81	16.2	95	14.4	89.6	15.5
Diabetic retinopathy	5	87.5	8.0	55	20.9	72	11	90	10.5	73.3	18.1	91.7	18.6	95.0	11.2	87.5	9.9	85	10.5	98.3	3.7	80	14.3	95	11.2	95	11.2
AMD Suspect	16	86.4	8.5	57.8	23.7	75.0	15.5	85.9	14.3	82.8	18.4	80.2*	18	95.3	9	86.7	10.4	86.7	14.8	99.5	2.1	72.7	17.2	98.4	6.3	87.5	15.8
Glaucoma suspect	11	89.7	8.8	68.2	22.6	78.2	18.9	80.7	18.8	84.8	19.7	93.2*	8.2	98.9	3.8	89.8	9	88.6	17.2	98.5	5	83	18.8	95.5	10.1	95.1*	10.1

Abbreviations: n; number, Visual Quality of Life, n; number, SD; Standard Deviation, VA; Visual Acuity, DR; Diabetic Retinopathy AMD; Age related Macular Degeneration. Statically significant difference between the group with eye disease and not: student-test: * p<0.05, * p<0.01 and ***.

4.5 Management

In total, 225 (76.8%) of the 293 participants were recommended glasses for distance or near, or wanted new glasses. Thirty-three (11.3%) were referred to an ophthalmologist or the case was discussed with their ophthalmologist, and for 14 (4.8%) a report was made to their ophthalmologist or their general practitioner. For 11 (3.8%) there was set a shorter interval than recommended by the general guidelines by the Norwegian Optometric association, and the interval followed the recommended follow up interval for the specific ocular condition.

5 Discussion

5.1 Visual function

This study found that 32.7% of the participants have reduced habitual vision and 9.9% were visual impaired. After refraction the number was reduced to 19.7% with reduced vision and 3.75% were visual impaired, similar to earlier findings in Norwegian optometric practice (Sundling et al., 2007). The reduction in number of participants with reduced vision and visual impaired after refractions indicates that we also have a large group with unnecessary reduced vision. This underline the importance for regular visual examinations (Attebo, Mitchell, & Smith, 1996; Sundling, 2011). Visual acuity below 0.8 is not expected for people under the age of 70 years unless they have an eye condition (Attebo et al., 1996; Elliott, 2008, pp. 34, 37). There was a significant improvement in visual acuity after refraction among 14.3% of the participants. This is a higher number than found among the Norwegian 65 years old, as they found an improvement of two lines with 5% (Sundling, 2011). This may be due to our sample being participants that may have attended the visual examinations due to symptoms compared to a random sample that Sundling looked at. The data in this study were more comparable with the Blue Mountains Eye study, who found under corrected refractive errors among 10.2% of the participants with presenting acuity 6/9 or worse (Thiagalingam et al., 2002). Attebo et al found that refraction improved VA with one line in 45% of the cases, and by three or more lines in 13% (Attebo et al., 1996). The higher number of people that improved visual acuity than found in Sundling may be related to the frequency of optometric examinations. Sundling found that the participants with more than 5 years since the last examination had a significant higher prevalence of uncorrected refractive errors (Sundling, 2011). As this study have not measured time since the last examination, it cannot be ruled out that there was a higher number of participant with longer frequencies between examinations than what Sundling had (Sundling, 2011).

The BCVA for the younger adults was 0.01. This is within the norm for the age groups, but as most of the participants were under 65 years we would expect VA more against -0.14 - -0.10logMAR (Elliott, 2008, p. 34). This may be related to the measurement of BCVA being measured in the trial flame. This will not be as accurate as a digital phoropter that would allow for accurate settings. We did not find a find a reduction of visual acuity for the participants over 65 as expected, as earlier findings show that visual acuity decline with increasing age (Attebo et al., 1996). This may be

related to the fact that we only have to different age groups, were the younger adults had a mean age at 55 years and the older adults 72 years. Attebo et al found that Snellen acuity 1.0 was 10 times more usual among people 49-55 years compared to 85 years indicating that if we had looked at VA with a broader range, we might have more similar results. Overall mean BCVA for all participants, was four letters poorer than Sundling, that looked at Norwegian 65-year-olds. Our mean age were 62 years. They found a mean BCVA at -0.06 (Sundling, 2011) compared to our 0.02logMAR. There is a clinical difference between the studies, however there is a good and similar VA in both studies. Near VA was significantly better than distance VA. The mean addition was +2.25DS (±0.45), within the norm for the age group (Elliott, 2008, p. 101). This implies that our participants are more affected in regard to distance activities compared to near activities. This study found mean contrast sensitivity to be 1.60log, with no difference between the two age groups. This is one letter poorer than Elliott reports for people over 50 years (Elliott, 2008, p. 61). There is no definitive cut off values for contrast sensitivity, and large individual variations is expected, our results may therefore be related to the number of participants in this study (Elliott, 2008, pp. 58-61). Binocular values are expected to be 0.15 log higher then monocular values when you obtain equal values monocular, this is comparable to our results with a statistically significant improvement binocular visual acuity compared to monocular. Overall, the results in this study for BCVA, near VA and contrast sensitivity was comparable to earlier studies and within what was expected for the age group.

Of the 293 participants 11 (3.75%) were visual impaired this is comparable to earlier studies (Attebo et al., 1996; Sundling et al., 2007). The Blue Mountains Study found a prevalence of mild visual impairment to be 3.4% (Attebo et al., 1996). Visual impairment is expected to increase with increasing age (Attebo et al., 1996), this was not found in this study. Again, this may be related to the two age groups or it may be related to the low number (n= 11) of participants who were visual impaired in our study. However, the results show that we have a high number of participants with reduced vision and visual impaired that will need optometrist, as a proper optometric solution may pay a large role in the individual's daily life. Today 1 of 10 over 66 years have vision related complaints with glasses (Folkehelseinstituttet, 2014), with the mean age of 62 years among the participants, they will have the need for optometric solutions and visual aids for a long period with increasing lifespan (Christiansen Solveig Tobie Glestad et al., 2014; Folkehelseinstituttet, 2014).

5.2 Refractive errors

Among the 293 participants 48.8% were hyperopic, 25.9% % emmetropic and 25.3% myopic in the right eye. The findings of hyperopia and myopia were similar to Sundling, but we found a smaller group of emmetropic participant than they found. They had a prevalence of hyperopia at 47%, 23% had myopia and 30% had emmetropia (Sundling, 2011). Attebo et al. found a higher prevalence were 57% were hyperopic compared to our 48%. For the emmetropic group there were more similar data with 28% compared to our 25.9%. The data were less similar for the myopic participants as they found a prevalence of 15% compared to our 25.3%. The age group is quite similar to our study, but we have a smaller sample (n = 293, compared to n=3654) which may cause different results (Attebo et al., 1996). We did not find a statistical difference in refractive error for participants over 65 years and younger participants, this may have been expected as increasing prevalence of hyperopia is more common with higher age (Wang, Klein, Klein, Moss, & Wang, 1994).

5.3 Ocular disease

This study showed that 21.1% had significant cataract. The prevalence of cataract depends largely on inclusion criteria in the studies and participant age. The results in this study is within what Prokofyeva reported in 2013, the prevalence in Europe ranged from 19.3-47.8 among people over 50 years (Prokofyeva, Wegener, & Zrenner, 2013). Sundling et al found a clinical finding of cataract in 18% among participants over 45 years, slightly lower than this study (Sundling et al., 2007). This may be related to their study group and examination methods, as they have a larger group of younger adults compared and a variety of examination methods compared to this study. Cataracts was divided as in Tan et al, the results showed that 14.7% had nuclear cataract (color/ opacity or both), 8.9% had significant cortical cataract and 1.2% had posterior subcapsular cataract. This is lower than what Tan et al found when grading with the LOCS III system. With the Wisconsin System, they found a prevalence for nuclear cataract to be 27.5% and 17%, 27.9% (7%) cortical and posterior 7.8% (5.1%). The prevalence in our study was more similar to what was found with the Wisconsin system. This may be due to our examination being mostly undilataded, as we only used Tropicamide on indications in the posterior segment. Differences in prevalence supports the statement from Tan that there is a need for global standards when assessing cataract in epidemiologic studies (Tan et al., 2011). The results in this study did not show that significant

cataract increased with increasing age, as expected (Prokofyeva et al., 2013). The non-significant relation between significant cataract and age is probably related to the two age groups in our study. Earlier research has shown a significant difference for people under the age of 65 compared to people over 85 years, which indicate that the mean age in the two groups in this study may be too similar, and the results may therefore be different if we had looked at age differently (Prokofyeva et al., 2013). Pseudophakia was present in 10.9% of the participants. There was a significantly higher number of participants with psaudoafakia among the older adults compared to the younger adults, this is as expected as the mean age of people being cataract operated in Norway is 77 years (Skau & Norsk oftalmologisk, 2012). Of the participants with pseudophakia, 34.4% had PCO. This is within the norm as a prevalence from 5-50% have been reported (Ursell et al., 2018). This study has not taken into account if the participants are newly operated or if they had had the intra ocular lenses for a time. This will influence how significant these results are as the age of the implant and material influence the rate of PCO (Ursell et al., 2018). There is a mismatch among participants who know they have cataract (5.4%) compared to the 19.1% that we found. This may be related to information to the patient. Low grade of cataract will maybe not be informed to the patient if there are no relevant symptoms. Development of cataract may also play a role here as well as how long there has been since the last visual examination, underlining the importance of regular eye examinations as cataract is one of the main reasons for unilateral vision loss (Gunnlaugsdottir, Arnarsson, & Jonasson, 2008).

The results showed a rate of diabetic retinopathy at 17.9%. This is higher then found in Sundling et al (Sundling et al., 2008) who found a prevalence of 10% among patients with diabetes, but more similar to what WHO reports(World-Health-Organisation, 2006). One of the main reasons this study detected more diabetic retinopathy than in Sundling et al may be because of the difference in investigative methods. We used Volk 90D and fundus photo, compared to direct ophthalmoscopy that was the most frequent method in the practice registration study by Sundling et al. Slit lamp examination with Volk 90D gives the advantage of stereoscopic view in addition to a larger field of view than with ophthalmoscopy. Fundus photo also give us the possibility to use filters/ enlarge pictures/zoom in which may make it more easily to detect retinopathy (Elliott, 2008, p. 248). There has been estimates of diabetic retinopathy to be 27-28% in Norway (Helsedirektoratet, 2019). The global prevalence of diabetic retinopathy depends on the duration of the diabetic diagnosis, 13%

has been reported for people who has had the diagnosis for less than 5 years and can be up to 90% among people who has had the diagnosis for 10-15 years. Another important factor is how well regulated the individual's diabetes is, as a diabetes that is poorly controlled will be more likely to cause complications (Helsedirektoratet, 2019; Sundling et al., 2008; World-Health-Organisation, 2006). As we have not recorded how long the participants had had the diagnosis, or how well regulated the diabetes is, we cannot accurately compare prevalence. In our study 3.6% reports that they have known diabetic retinopathy, compared to the 17.9% we found, there is either a high number of undiagnosed retinopathy or there is a mismatch between findings and information provided to the patient, or maybe both. It is reported that 13% of patients with diabetes who are in the diabetic retinopathy screening program have the diagnosis diabetic retinopathy, but only 27% of patients with diabetes are in this program (Helsedirektoratet, 2018, 2019). One of the reasons to the mismatch in findings of retinopathy may therefore be related to the program participation, as 25% of our participants was not referred for screening of diabetic retinopathy.

This study shows that 5.6% of the participants has suspected AMD, this is low compared what has been reported in earlier studies (Wong et al., 2014). This may be related to AMD progressing with age (Norsk oftalmologisk forening, Berg, & Jørstad, 2016; Skau & Norsk oftalmologisk, 2012; Wong et al., 2014). The progression of AMD with age may also explain why only 1% reports an AMD diagnosis, as changes may have happened since the last examination. There is also a chance that the participants were not informed about findings if there was a low degree of severity in findings and no symptoms in the last examination. Our low number of participants (n=16), may also influence the results. Studies on European population shows a prevalence for any AMD to be 12.3%, early AMD to be 11.3% and late AMD to be 0.5% (Wong et al., 2014). The Oslo Macular Study showed a prevalence of early AMD to be 43.1% (Björnsson, Syrdalen, Bird, Peto, & Kinge, 2006). The differences in results is probably mainly based on method as these studies look at fundus photo to grade AMD, unlike this study that has Amsler, photo and OCT as a criterion. OCT pictures have great advantages in detecting structures and size of drusen, Retinal Pigment Epithelium (RPE)- changes and the presents of fluid between layers, especially in combination with fundus photo, cross sectional images may also make it easier to detect findings (Garcia-Layana, Ciuffo, Zarranz-Ventura, & Alvarez-Vidal, 2017). If we had looked at only the fundus pictures it is likely that we would have a larger prevalence as we have a large portion of ungradable pictures, and there would have been a larger group to analyze. OCT and Amsler is recommended as first

examinations in participants with AMD, and important tool for AMD follow-up, and therefore a natural criterion to implement when looking at AMD suspicious participants (Bishop). If we had used Amsler as the only criterion we would have a prevalence of 13% which is more comparable to earlier findings for any AMD. Amsler is known for false negative results and should therefore not be the only criteria (Crossland & Rubin, 2007). In our study there was less participants with findings on OCT or photo than participants with findings on Amsler, indicating a false positive result with Amsler in this study. This shows that Amsler is not to be used as the one and only test, as this would create a high rate of referrals without proper cause. However, the low results imply that we have a too harsh criterion for any or early AMD, and a too wide criteria to detect the late AMD participants. This underline the importance in knowing the strength and weakness of each test, and that we as optometrists have to use the correct tests at the right time to ensure that we make the right decisions in regard to follow-up.

Of the 293 participants in our study, 3.6% had suspected glaucoma based on visual field taken on indication in suspicious changes/results to optic nerve, IOP, and temporal anterior chamber angle. This is comparable to the global estimate of glaucoma at 3.54% (Barkana & Dorairaj, 2015). The NICE guidelines recommend referral if there is a presence of IOP equal or larger then 24mmHg, glaucoma change to the optic nerve and glaucomatous visual field damage after the tests has been confirmed with eventual retesting (NICE National Institute for Health and Care Excellence, 2017). Referral should not solely be based on one single factors. Our prevalence would for example be 10.2% if we had set the criteria for glaucoma suspicious to be one or more finding of the following: ISNT rule broken, visual field or IOP over 24mmHg or with a difference of 4mmHg or more. Here optometrists have a key role, if we do not confirm results or sort out the incorrect measurements, it will create a high rate of referrals which again create a burden to the specialist care. Only 1.8% reported a present glaucoma diagnosis in the history compared to the 3.6% that we found. This shows that optometrist do detect findings that need further follow-up, either by ophthalmologist or by the optometrist.

There was a high rate (83.9%) of ocular findings with fundus photo. These findings range from normal variations to findings with need for extra means in terms of follow-up or referral. Fundus photography is a good supplement tool in regards to documentation of findings, and to detect changes over time (Elliott, 2008, p. 248). Our results are not high when we know that the findings

range from on finding in one area to several findings in multiple area. Earlier studies has shown that drusen is present in 34% of the participants in the Tromsø study (Erke et al., 2012). If we add there is most findings in papillae where normal variations is common (Elliott, 2008, pp. 282-286) , than 83.9% is not an a remarkable result. However, it would have been interesting to look at the severity of the findings as earlier studies on diabetic retinopathy has shown a specificity in 77% in undialated fundus photos (Murgatroyd et al., 2004). The sensitivity in sight threatening diabetic retinopathy was 38-100% and a specificity ranging from 75-100% compared to mydriatic examinations by an ophthalmologist (Williams et al., 2004). Williams et al found that single images could not be the only investigation, and did not substitute the examinations by ophthalmologists (Williams et al., 2004). The results in this study also indicate that fundus photo should not be the only examination as we get a lot of findings without knowing the background. Therefore, if we believe that earlier studies on diabetic retinopathy can be transferred to other conditions, it would be interesting to look at the severity of the findings in this study. There is no doubt that there is a large documentation value in fundus photos, with regard to future follow-up for the individual participant (Elliott, 2008, p. 248). We had a large number of ungradable images, mydriases would likely have reduced the number of non-gradable images (Murgatroyd et al., 2004).

5.4 Visual Quality of Life

In this study we found comparable overall mean scores of VQoL with earlier studies (Chia et al., 2006; Clemons, Chew, Bressler, & McBee, 2003). We did not find a difference between the group over 65 years compared to the group under when looking at the overall mean score (VQoL). This is comparable to the Blue mountain Study (Chia et al., 2006). They found poor association between age and decreasing NEI VFQ-25 scores (Chia et al., 2006). The overall good mean NEI VFQ-25 score may be related to the good visual acuity and contrast sensitivity, this is in line with previous findings (Schwartz, 2010, pp. 190-193). The group with older adults had a significant poorer score for the subscale groups driving and general health, this was also significant in the AREDS study (Clemons et al., 2003). In relations to driving we as optometrist have a responsibility with renewals of drivers licenses (Helsedirektoratet, 2016b). As we have an aging populations the relations with driving and VQoL is an important factor to pe aware of (Christiansen Solveig Tobie Glestad et al., 2014; Folkehelseinstituttet, 2014). The AREDS study found a significant change in the subscale groups driving and general health for people over 75 years of age (Clemons et al., 2003). The mean

age for the older age group in this study was 71 years, the trend with a poorer subscale score in general health is therefore logical. There was also a significantly larger number of participants with cardiovascular disease and high blood pressure among participants over the age of 65. Health issues are more prone to older people (Folkehelseinstituttet, 2014).

When comparing, age influenced two subcategories (driving and general health), while reduced vision did not affect VQoL or the subcategories. This may be related to the severity the vision loss, and overall good visual acuity in this study group, as earlier studies has shown that reduced vision affected vision related quality of life depending on cause and if the vision loss is unilateral or bilateral (Chia et al., 2006). Our criterion of reduced vision is VA below 0.8, therefore we cannot conclude that VA does not affect VQoL, only that with our definition of reduced vision there was no significantly poorer VQoL compared to people with normal vision. This implies that participant may have to have a more severe vision loss before the VQoL is reduced. The participants with suspected AMD in this study had a significantly poorer score in regard to distance vision, compared to the group without diagnosis. This is in some degree comparable to Choudhury et al. who found that in early AMD participants had reduced VQoL in the subcategories driving, near vision, role and social functioning (Choudhury et al., 2016). Our participants had reduced score in the subcategories driving and role difficulties, but not in near vision and social functioning. This may be related to the low number of participants with suspected AMD (n=16) compared to the large number of participants (n=474) in Choudhury et al. It may also be related to the AMD criterion being too strict to detect all participants with any AMD. The mean VA for participants with suspected AMD was good. Another important factor is that VQoL among participants has shown to decrease with increasing severity of the disease (Clemons et al., 2003), which we have not investigated. The glaucoma suspected participants in this study have significantly higher scores in the subcategories distance activities and peripheral vision. This may be related to the low number of participants with glaucoma compared to persons with no eye conditions, and the good mean VA in the group. Patients answered the questionnaire with their habitual refraction. It was a larger group of participants in the no ocular disease category, this may have led to a larger variance in results compared to the glaucoma suspect group. A reduction in VQoL is expected as the disease progress, and visual field deteriorates (Blumberg et al., 2017). This indicates that our participants with suspected glaucoma are not severely affected. Riva et al found that participants with glaucoma had

poorest score in regard to general health and general vision at baseline, this is comparable to our results(Riva et al., 2019).

The patients with significant cataract in this study has poorer scores in all subcategories but most reduced scores in regard to general health, general vision, near activities and driving, this was not significant. The results is in some degree comparable to earlier findings, where the subscale scores general vision, distance activities, mental health and driving was the most affected scores (Clemons et al., 2003). Cataract patients seem to have a lower VQoL depending on how reduced vision is (Clemons et al., 2003). This may imply that our participants with cataract is not severely affected in regard to VA. The relation between significant cataract and VA was not investigated in this study. We did not find a significantly reduced score for diabetic retinopathy patients as expected (Mazhar et al., 2011). This may imply that our participants is not severely affected as severity of the disease affect VQoL (Pereira et al., 2017). Trento et al looked at participants with Snellen VA below 0.5 and found a decreased score for ocular pain, near vision, distance vision, social functioning, role difficulties, dependency and color vision (Marina Trento et al., 2013).There is not a general lower score in our diabetic patients, but the sub scores general health, general vision, near activities and mental health was poorer than for the participants without an eye condition. The differences in the results between Trento et al and us is probably related to the reduced VA among participants in their study, in addition to their larger sample of participants compared to the five participants in this study.

5.5 Management

Of our 293 participants, 76.8% was recommended glasses for distance or near, or because of damaged glasses. As refractive error is the main reason for reduced vision, and often why the patient orders the appointment it is natural that there is a larger group who need new corrective means (Attebo et al., 1999). This shows that the main task of us as optometrists is to make good visual aids adapted to the individual needs. The group who got new glasses is much higher than the 14.3% who had significant improved visual acuity. This may imply that for the patient a change that is less then 2 lines may be significant. It is also more comparable to earlier studies who have found that 45.3%-57% of the participants improved their visual acuity by one line or more with refraction (Thiagalingam et al., 2002). Of course, some also got new glasses because they wanted to or their

old ones were ruined, some may need additional glasses as their need may have change since they last got new glasses. This may be a contributing factor in the high number of renewals.

In 11.3% of the cases a referral was necessary, or the case got discussed with their ophthalmologist. This is a high number compared to earlier studies who have found 3.6% and 6% referral rate (Lundmark & Luraas, 2017; Sundling et al., 2007). Although, Lundmark and Luraas suspected the referral rate to be higher than reported in their study (Lundmark & Luraas, 2017). Our results was within the 2-24% that Brin and Griffin found (Brin & Griffin, 1995). The higher number of referrals may be related to our higher participant age than in Sundling et al study. We also have a higher number of cataract and eye diseases then Sundling et al, and a large number of new disclosures of eye diseases or suspected eye diseases, which will imply a higher need for referral. AMD, cataract and glaucoma is already the main burden of appointments in the specialist care in Norway, it is expected that there will be a 76% increase in consultations among these diagnosis in 2030 (Skau & Norsk oftalmologisk, 2012). Therefore, it is substantial that we as optometrist is aware of our role and do not refer unnecessarily as that would create a burden to our specialist services and a cost to the welfare systems. The mean age in this study is 62 years, indicating that they will have the need for optometric solutions and visual aids for a long period with increasing lifespan (Folkehelseinstituttet, 2014). It is known that elderlies have more complaints about their vision than youngers even with glasses (Folkehelseinstituttet, 2014). A study conducted by Statistical Central burau in 2003 found that 7% of people over 60 years had difficulties in the daily life due to reduced vision (Statistisk-Sentralbyrå, 2003). Our study is conducted by one optometrist and the results may not be generalizable. One may also think that as some of these 11.3% is conversations with an ophthalmologist, some of these referrals may have been categorized as reports. Our report rate was at 4.8% which is also higher than the 2.8% in Sundling et al (Sundling et al., 2007). It can be debated if there is a too high rate of reports or if 4.8% is a too low rate as interdisciplinary work always should be aimed for.

In summary this study has documented the visual function and VQoL for a large number of participants with standard optometric examinations in an optometric practice. As the study is done in one optometric practice, one should be careful not to generalize, even though the findings are partly comparable to previously Norwegian studies and international population-based studies. The study investigated a limited selection who ordered an appointment at Specsavers Haugesund. As

the participants ordered an appointment it is indications that they had symptoms of some sort. This is of value in a clinical perspective as prevalence studies give a picture of the general population and not necessarily how the daily life in an optometric practice is. Only one optometrist in the store examined patients, as this optometrist is not at work all the time it was not possible to exanimate all the participants who met the inclusion criteria which again make the sample inconclusive. A selection bias may have happened as the optical assistants booked an appointment with the project optometrist and some participants may have requested the project optometrist. This study only shows results from one store in one region in Norway which give a poor picture of the Norwegian situation and differences between optical chains/ stores may happen as different stores may attract different costumer groups.

6 Conclusion

This study shows that we as optometrist have an important role in the health care system as our results show that 14% of participants had a significant improvement in VA, two lines or more, after refraction. There is an overall good visual function among the participants, however almost 20% have reduced vision ($0.5 \leq BCVA < 0.8$) and 4% were visual impaired ($VA < 0.5$) with best correction. Of the total 293 participants 26% had one or more diagnosis of cataract, diabetic retinopathy, were AMD suspicious or glaucoma suspicious. The visual examination disclosed new ocular disease in 25% of the 293 participants. Overall, the VQoL is good among the participants. There was not a significant difference in VQoL in participants with reduced vision, cataract and diabetic retinopathy compared to the group without eye conditions. AMD suspicious participants had a significantly poorer score in the NEI VFQ-25 subcategory distance activities compared to the group without eye conditions. The results also showed a significantly better score for the sub scores distance activities and peripheral vision in our glaucoma suspicious participants compared to the group without eye conditions. Higher age had significantly poorer score in regard to general health and driving. With increasingly higher age in the population optometrists have an important role as our results show that visual examinations can reveal uncorrected refractive errors and can prevent unnecessarily reduced vision because of ocular disease, which again contributes god VQoL.

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List of tables and charts

List of abbreviations

AMD: Age-related macular degeneration

VQoL: Visual Quality of Life

NEI VFQ: National Eye Institute Visual Function Questionnaire

NEI VFQ-25: National Eye Institute Visual Function Questionnaire 25 item

HRQOL: Health-Related Quality Of Life

VA: Visual acuity

BCVA: Best corrected visual acuity

SD: Standard deviation

SER: Spherical equivalent power

OCT: Optical coherence tomography

IOP: Intra ocular pressure

C/D: Cup/disk ratio

A/V: Arterial/ vein ratio

X^2: Chi- Square

FET: Fisher exact test

n= number

HVA: Habitual visual acuity

OD: oculus dextrus,

OS: Oculus sinister

BIN: binocular

PCO: Posterior capsular opacification

DR: Diabetic retinopathy

RPE: Retinal Pigment Epithelium

Annexes

Annex 1: Information about the study and consent form.

Annex 2: National Eye Institute Spørreskjema om synsfunksjon - 25 (VFQ-25)

Annex 3: The National Eye Institute 25-Item Visual Function Questionnaire (VFQ-25), manual.

Annex 1: Information about the study and consent form.

FORESPØRSEL OM DELTAKELSE I FORSKNINGSPROSJEKTET

REFRAKSJONSFEIL, ØYESYKDOM OG SYNSRELATERT LIVSKVALITET BLANT VOKSNE PASIENTER I EN NORSK OPTOMETRISK PRAKSIS

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å undersøke hvordan refraksjonsfeil, katarakt (grå stær), aldersrelatert makula degenrasjon (AMD), glaukom (grønn stær) og diabetes påvirker synsrelatert livskvalitet blant pasienter over 45 år. Du forespørres om å delta i prosjektet fordi du har vært til synsundersøkelse hos Specsavers Haugesund, H. Holgersen optikk AS. Forskningsprosjektet gjennomføres som en del av en masteroppgave ved Institutt for optometri, radiografi og lysdesign, Fakultet for helse og sosialvitenskap ved Universitet i Sørøst-Norge.

HVA INNEBÆRER PROSJEKTET?

Ved deltagelse i prosjektet vil du bli bedt om å fylle ut et spørreskjema knyttet til hvordan synet ditt påvirker din hverdag og livskvalitet. I tillegg vi vil registrere resultater knyttet synsfunksjon og øyehelse fra synsundersøkelse som du nettopp har gjennomført, og kjønn og alder. Opplysningene dine vil under prosjektperioden være knyttet til en navneliste gjennom en kode. Denne kodenøkkelen vil slettes når datainnsamlingen er gjennomført. De lagrede opplysningene vil i etterkant ikke kunne knyttes til deg som person.

MULIGE FORDELER OG ULEMPER

Som deltaker i prosjektet vil du få kartlagt synsrelatert livskvalitet. Informasjonen fra dette spørreskjemaet vil knyttes direkte til synsundersøkelsen som du nettopp har gjennomført. Det inkluderer vurdering av din brillestyrke, synsfunksjon (synsskarphet, kontrastfølsomhet og synsfelt) og øyehelse (undersøkelse av øyets fremre og bakre segment, trykkmåling, netthinnefoto, og måling av hornhinnetykkelse og OCT-scan ved indikasjon) i forhold synsrelatert livskvalitet. Du vil bli gitt veiledning om ditt syn og få råd om synshjelpemidler og synsergonomiske tiltak som er relevant for deg og ditt syn. Dersom det er oppdaget øyesykdom eller andre tilstander som krever henvisning øyelege/lege vil oppfølging vil bli gitt.

Det er ikke knyttet risiko, betydelig ubehag eller bivirkninger til studien.

FRIVILLIG DELTAKELSE OG MULIGHET FOR Å TREKKE SITT SAMTYKKE

Det er frivillig å delta i prosjektet. Dersom du ønsker å delta, undertegner du samtykkeerklæringen på siste side. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke. Dette vil ikke få konsekvenser for din videre behandling hos Specsavers Haugesund, H. Holgersen optikk AS. Dersom du trekker deg fra prosjektet, kan du kreve å få slettet innsamlede prøver og opplysninger, med mindre opplysningene allerede er inngått i analyser eller brukt i vitenskapelige publikasjoner. Dersom du senere ønsker å trekke deg eller har spørsmål til prosjektet, kan du kontakte optiker og masterstudent Hanne Tangen Rørdal, 52709400. hannetangen.rordal@gmail.com

HVA SKJER MED INFORMASJONEN OM DEG?

Informasjonen som registreres om deg skal kun brukes slik som beskrevet i hensikten med studien. Du har rett til innsyn i hvilke opplysninger som er registrert om deg og rett til å få korrigert eventuelle feil i de opplysningene som er registrert.

Alle opplysningene vil bli behandlet uten navn og fødselsnummer eller andre direkte gjenkjennende opplysninger. En kode knytter deg til dine opplysninger gjennom en navneliste.

Prosjektleder, førsteamanuensis Vibeke Sundling, Fakultet for Helsevitenskap, Institutt for Optometri og Synsvitenskap ved Nasjonalt Senter for optikk syn og øyehelse har ansvar for den daglige driften av forskningsprosjektet og at opplysninger om deg blir behandlet på en sikker måte. Informasjon om deg vil bli anonymisert eller slettet senest fem år etter prosjektslutt. Prosjektleder kan kontaktes på tlf: 924 24 360 eller vibeke.sundling@usn.no .

FORSIKRING [BESKRIV DET SOM ER AKTUELT]

Pasientskadeloven.

GODKJENNING

Prosjektet er godkjent av Regional komite for medisinsk og helsefaglig forskningsetikk, 2018/1029/REK nord

REFRAKSJONSFEIL, ØYESYKDOM OG SYNSRELATERT LIVSKVALITET BLANT VOKSNE PASIENTER I EN NORSK OPTOMETRISK PRAKSIS

SAMTYKKE TIL DELTAKELSE I PROSJEKTET

JEG ER VILLIG TIL Å DELTA I PROSJEKTET

Sted og dato

Deltakers signatur

Deltakers navn med trykte bokstaver

Jeg bekrefter å ha gitt informasjon om prosjektet

Sted og dato

Signatur

Masterstudent

PB/SA

National Eye Institute
Spørreskjema om synsfunksjon - 25
(VFQ-25)

(FOR EGENUTFYLLING)

Februar 1997

Dette er et spørreskjema med utsagn om problemer du har med synet ditt, eller følelser du har omkring dette. Etter hvert spørsmål ber vi deg velge det svaret som best beskriver din egen situasjon.

Vennligst svar på alle spørsmålene som om du hadde på deg dine briller eller kontaktlinser (hvis du bruker noe av dette).

Vennligst ta den tiden du trenger for å svare på hvert spørsmål. Alle svar behandles konfidensielt. For at denne spørreundersøkelsen skal øke vår kunnskap om synsproblemer og hvorledes disse problemene påvirker din livskvalitet, må svarene være så presise som mulig. Husk at dersom du bruker briller eller kontaktlinser, så vennligst svar på alle spørsmålene som om du hadde dem på deg.

VEILEDNING:

1. I det store og hele vil vi helst at folk forsøker å fylle ut disse skjemaene på egenhånd. Dersom du merker at du trenger hjelp, så vennligst ikke nøl med å henvende deg til prosjektmedarbeiderne, som vil gi deg assistanse.

2. Vennligst svar på alle spørsmålene (unntatt de spørsmålene du blir bedt om å hoppe over, fordi det/de neste spørsmål(ene) ikke angår deg).

3. Svar på spørsmålene ved å sette en ring rundt tallet for det svaret som passer.

4. Hvis du er usikker på hvilket svar du skal velge, vennligst velg det svaret som passer best, og sett en kommentar i venstre marg.

5. Vennligst fyll ut skjemaet før du går herfra og gi det til en av prosjektmedarbeiderne. Ta ikke med skjemaet hjem.

6. Hvis du har noen spørsmål, må du gjerne spørre en av prosjektmedarbeiderne, og de vil med glede hjelpe deg.

KONFIDENSIELLE OPPLYSNINGER:

Alle opplysninger som kunne tillate identifisering av en person som har fylt ut dette skjemaet, skal anses som strengt konfidensielle. Slike opplysninger vil bare bli brukt til denne undersøkelsens formål, og vil ikke være tilgjengelige for innsyn eller bruk til andre formål uten forhåndssamtykke, unntatt dersom loven krever det.

Spørreskjema om synsfunksjon - 25

DEL 1 - HELSE OG SYN GENERELT

1. <u>Stort sett</u>, vil du si at din <u>helse</u> alt i alt er:

(Sett ring rundt ett tall)

Utmerket 1
Meget god..... 2
God 3
Nokså god 4
Dårlig 5

2. Vil du si at synet ditt på det nåværende tidspunkt, når du bruker begge øynene (med briller eller kontaktlinser hvis du bruker det), er <u>utmerket</u>, <u>godt</u>, <u>nokså godt</u>, <u>dårlig</u> eller <u>meget dårlig</u>, eller er du <u>helt blind</u>?

(Sett ring rundt ett tall)

Utmerket 1
Godt 2
Nokså godt..... 3
Dårlig 4
Meget dårlig 5
Helt blind 6

NEI-VFQ25-SA – Norway/Norwegian – Version of 09 Aug 02 – Mapi.
ID1742 / NEI-VFQ25-SA_AU1.0_nor-NO.doc

3. Hvor ofte bekymrer du deg om synet ditt?

(Sett ring rundt ett tall)

Aldri 1
Sjelden..... 2
Iblant..... 3
Ofte 4
Alltid 5

4. Hvor mye smerte eller ubehag har du hatt i eller rundt øynene (for eksempel at det brenner, klør eller gjør vondt)?

(Sett ring rundt ett tall)

Ingen/ikke noe..... 1
Mild(t)..... 2
Moderat..... 3
Sterk(t)..... 4
Meget sterk(t)..... 5

DEL 2 - VANSKER MED GJØREMÅL

De neste spørsmålene dreier seg om hvor store vansker, om noen, du har med å utføre visse gjøremål når du bruker briller eller kontaktlinser, dersom du bruker briller eller kontaktlinser til slike gjøremål.

5. Hvor store vansker har du med å lese vanlig skrift i en avis?

(Sett ring rundt ett tall)

Ingen vansker i det hele tatt 1
Små vansker 2
Moderate vansker..... 3
Svært store vansker..... 4
Har sluttet å gjøre dette pga. synet 5
Har sluttet å gjøre dette av andre grunner, eller er ikke interessert i å gjøre dette 6

6. Hvor store vansker har du med å drive med arbeid eller hobbyer som krever at du må se godt på kort avstand, slik som matlaging, søm, småreparasjoner i hjemmet eller bruk av håndholdt verktøy?

(Sett ring rundt ett tall)

Ingen vansker i det hele tatt	**1**
Små vansker	**2**
Moderate vansker	**3**
Svært store vansker	**4**
Har sluttet å gjøre dette pga. synet	**5**
Har sluttet å gjøre dette av andre grunner, eller er ikke interessert i å gjøre dette	**6**

7. Hvor store vansker har du, på grunn av synet ditt, med å finne noe på en overfylt hylle?

(Sett ring rundt ett tall)

Ingen vansker i det hele tatt	**1**
Små vansker	**2**
Moderate vansker	**3**
Svært store vansker	**4**
Har sluttet å gjøre dette pga. synet	**5**
Har sluttet å gjøre dette av andre grunner, eller er ikke interessert i å gjøre dette	**6**

8. Hvor store vansker har du med å lese veiskilt eller navnet på butikker?

(Sett ring rundt ett tall)

Ingen vansker i det hele tatt	**1**
Små vansker	**2**
Moderate vansker	**3**
Svært store vansker	**4**
Har sluttet å gjøre dette pga. synet	**5**
Har sluttet å gjøre dette av andre grunner, eller er ikke interessert i å gjøre dette	**6**

9. Hvor store vansker har du, på grunn av synet ditt, med å gå ned trinn, trapper eller fortauskanter i svak belysning eller når det er mørkt?

(Sett ring rundt ett tall)

Ingen vansker i det hele tatt	**1**
Små vansker	**2**
Moderate vansker	**3**
Svært store vansker	**4**
Har sluttet å gjøre dette pga. synet	**5**
Har sluttet å gjøre dette av andre grunner, eller er ikke interessert i å gjøre dette	**6**

10. Hvor store vansker har du, på grunn av synet ditt, med å legge merke til gjenstander som er til siden for deg når du er ute og går?

(Sett ring rundt ett tall)

Ingen vansker i det hele tatt	**1**
Små vansker	**2**
Moderate vansker	**3**
Svært store vansker	**4**
Har sluttet å gjøre dette pga. synet	**5**
Har sluttet å gjøre dette av andre grunner, eller er ikke interessert i å gjøre dette	**6**

11. Hvor store vansker har du, på grunn av synet ditt, med å se hvordan folk reagerer på ting du sier?

(Sett ring rundt ett tall)

Ingen vansker i det hele tatt	**1**
Små vansker	**2**
Moderate vansker	**3**
Svært store vansker	**4**
Har sluttet å gjøre dette pga. synet	**5**
Har sluttet å gjøre dette av andre grunner, eller er ikke interessert i å gjøre dette	**6**

12. Hvor store vansker har du, på grunn av synet ditt, med <u>å velge og sette sammen dine egne klær</u>?

(Sett ring rundt ett tall)

Ingen vansker i det hele tatt 1
Små vansker 2
Moderate vansker 3
Svært store vansker 4
Har sluttet å gjøre dette pga. synet 5
Har sluttet å gjøre dette av andre grunner, eller er ikke interessert i å gjøre dette 6

13. Hvor store vansker har du, på grunn av synet ditt, med <u>å være sammen med mennesker hjemme hos folk, i selskaper eller på restauranter</u>?

(Sett ring rundt ett tall)

Ingen vansker i det hele tatt 1
Små vansker 2
Moderate vansker 3
Svært store vansker 4
Har sluttet å gjøre dette pga. synet 5
Har sluttet å gjøre dette av andre grunner, eller er ikke interessert i å gjøre dette 6

14. Hvor store vansker har du, på grunn av synet ditt, med <u>å gå på forestillinger/oppvisninger, i teater eller på sportsbegivenheter</u>?

(Sett ring rundt ett tall)

Ingen vansker i det hele tatt 1
Små vansker 2
Moderate vansker 3
Svært store vansker 4
Har sluttet å gjøre dette pga. synet 5
Har sluttet å gjøre dette av andre grunner, eller er ikke interessert i å gjøre dette 6

15. Kjører du selv bil for tiden, i alle fall en gang iblant?

(Sett ring rundt ett tall)

Ja ..... 1 ***Gå til spm. 15c***

Nei..... 2

15a. HVIS NEI: Har du aldri kjørt bil, eller har du sluttet med å kjøre?

(Sett ring rundt ett tall)

Har aldri kjørt... 1 ***Gå til del 3, spm. 17***

Har sluttet..... 2

15b. HVIS DU HAR SLUTTET Å KJØRE: Sluttet du først og fremst på grunn av synet, først og fremst av andre grunner, eller både på grunn av synet og av andre grunner?

(Sett ring rundt ett tall)

Først og fremst synet..... 1 ***Gå til del 3, spm. 17***

Først og fremst andre grunner.... 2 ***Gå til del 3, spm. 17***

Både synet og andre grunner..... 3 ***Gå til del 3, spm. 17***

15c. HVIS DU KJØRER SELV FOR TIDEN: Hvor store vansker har du med å kjøre på dagtid på kjente steder?

(Sett ring rundt ett tall)

Ingen vansker i det hele tatt..... 1
Små vansker..... 2
Moderate vansker..... 3
Svært store vansker..... 4

16. Hvor store vansker har du med <u>å kjøre når det er mørkt</u>?

(Sett ring rundt ett tall)

Ingen vansker i det hele tatt 1
Små vansker 2
Moderate vansker 3
Svært store vansker 4
Har sluttet å gjøre dette pga. synet 5
Har sluttet å gjøre dette av andre grunner, eller er ikke interessert i å gjøre dette..... 6

16a. Hvor store vansker har du med <u>å kjøre under vanskelige forhold, slik som i rushtiden, på motorveien, i bytrafikk eller i dårlig vær</u>?

(Sett ring rundt ett tall)

Ingen vansker i det hele tatt 1
Små vansker 2
Moderate vansker 3
Svært store vansker 4
Har sluttet å gjøre dette pga. synet 5
Har sluttet å gjøre dette av andre grunner, eller er ikke interessert i å gjøre dette..... 6

DEL 3 - KONSEKVENSER AV SYNSPROBLEMER

De neste spørsmålene dreier seg om hvorledes ting som du gjør kan bli påvirket av synet ditt. For hvert spørsmål ber vi deg sette en ring rundt det tallet som viser om utsagnet stemmer for deg alltid, ofte, iblant, sjelden eller aldri.

	(Sett ring rundt ett tall på hver linje) Alltid	Ofte	Iblant	Sjelden	Aldri
17. Får du utrettet mindre enn det du kunne ønske på grunn av synet?.....	**1**	**2**	**3**	**4**	**5**
18. Er det begrenset hvor lenge du kan arbeide eller drive med andre gjøremål på grunn av synet?	**1**	**2**	**3**	**4**	**5**
19. Hvor mye hindrer smerte eller ubehag i eller rundt øynene (for eksempel at det brenner, klør eller gjør vondt) deg i å drive med det du har lyst til å drive med?.....	**1**	**2**	**3**	**4**	**5**

For hvert av de følgende utsagnene ber vi deg sette en ring rundt det tallet som viser om utsagnet gjelder for deg i meget stor grad, i stor grad, i liten grad eller overhodet ikke, eller om du er usikker.

(Sett ring rundt ett tall på hver linje)

	I meget stor grad	I stor grad	Usikker	I liten grad	Over-hodet ikke
20. På grunn av synet holder jeg meg hjemme mesteparten av tiden	**1**	**2**	**3**	**4**	**5**
21. På grunn av synet føler jeg meg oppgitt og frustrert mye av tiden	**1**	**2**	**3**	**4**	**5**
22. På grunn av synet har jeg mye mindre kontroll over det jeg gjør	**1**	**2**	**3**	**4**	**5**
23. På grunn av synet må jeg stole alt for mye på det andre folk forteller meg.....	**1**	**2**	**3**	**4**	**5**
24. På grunn av synet trenger jeg mye hjelp fra andre.....	**1**	**2**	**3**	**4**	**5**
25. På grunn av synet bekymrer jeg meg for å gjøre ting som vil være pinlig for meg selv eller andre.....	**1**	**2**	**3**	**4**	**5**

Version 2000

The National Eye Institute 25-Item Visual Function Questionnaire (VFQ-25)

Version 2000

This final version of the VFQ-25 differs from the previous version in that it includes an extra driving item from the appendix of supplementary questions as part of the base set of items. Also, the revised scoring algorithm excludes the single-item general health rating question from the calculation of the vision-targeted composite score. Because of these 2 changes, the base set of items actually includes 26 questions, however, only 25 are vision-targeted and included in the composite score. Please see the "Frequently Asked Questions" or FAQ section for additional clarifications of these changes.

Background

The National Eye Institute (NEI) sponsored the development of the VFQ-25 with the goal of creating a survey that would measure the dimensions of self-reported vision-targeted health status that are most important for persons who have chronic eye diseases. Because of this goal, the survey measures the influence of visual disability and visual symptoms on generic health domains such as emotional well-being and social functioning, in addition to task-oriented domains related to daily visual functioning. Questions included in the VFQ-25 represent the content identified during a series of condition-specific focus groups with patients who had age-related cataracts, glaucoma, age-related macular degeneration, diabetic retinopathy, or CMV retinitis. [1]

The VFQ-25 is the product of an item-reduction analysis of the longer field test version of the survey called the 51-item National Eye Institute Vision Function Questionnaire (NEI-VFQ).[2] The longer version contains 51 questions which represent 13 different sub-scales. The NEI-VFQ Field Test Study collected the data needed to examine the reliability and validity of the survey across all of the above-mentioned ocular diseases. Also, reliability and validity was assessed in a heterogeneous group of patients with low vision from any cause and a group of age-matched persons with normal vision. A published report describes the psychometric properties of the longer field test version of the survey. [3] Additional a number of clinical studies have used either the 51 or the 25-item version of the NEI-VFQ across a number of chronic ocular conditions. [4-8] Despite the success of the longer field test version and its continued use, to enhance feasibility a short-form version was planned since the earliest developmental phase.

The VFQ-25 consists of a base set of 25 vision-targeted questions representing 11 vision-related constructs, plus an additional single-item general health rating question. The VFQ-25 also includes an appendix of additional items from the 51-item version that researchers can use to expand the scales up to 39 total items. All items in the VFQ-25 are from the 51-item field test version; no new items were developed for use in the VFQ-25. Unless otherwise specified, the remainder of this document will use the term VFQ-25 to refer to the base set of items.

The VFQ-25 takes approximately 10 minutes on average to administer in the interviewer format. There is also a self-administered version of the survey, however, psychometric testing of the self-administered version has not been done. The VFQ-25 generates the following vision-targeted sub-scales: global vision rating (1), difficulty with near vision activities (3), difficulty with distance vision activities (3), limitations in social functioning due to vision (2), role limitations due to vision (2), dependency on others due to vision (3), mental health symptoms due to vision (4), driving difficulties (3), limitations with peripheral

(1) and color vision (1), and ocular pain (2). Additionally, the VFQ-25 contains the single general health rating question which has been shown to be a robust predictor of future health and mortality in population-based studies. Please see the FAQ section for more information about the general health rating question.

Development of the NEI VFQ-25

The guiding principles for the selection of the short-form items included: 1) low item-level missing data rates; 2) normal distribution of response choices; and 3) retention of items that explained the greatest proportion of variance in the 51-item sub-scales. The items retained in the VFQ-25 and the optional items (provided in the appendix to the survey) are listed on Table 1. A report describing the performance of the VFQ-25 relative to the Field Test version is currently under review.[2] The reliability and validity of the VFQ-25 is similar to that observed for the 51-item version of the survey. On average, each VFQ-25 sub-scale predicts 92% of the variance in the corresponding 51-item sub-scale score.

Optional Items

Appendix 1 consists of additional questions that users may add to a specific sub-scale. Inclusion of these may be helpful if a particular sub-scale represents the primary domain of vision-targeted HRQOL that is felt to be most important for the condition under study. For example, if a user is testing a new treatment for macular degeneration, by adding near vision questions A3, A4, and A5 to VFQ-25 questions 5, 6, and 7, the investigator would have a six-item near vision scale rather than a three-item scale. The addition of these items would enhance the reliability of the near vision sub-scale and is likely to improve the responsiveness of the sub-scale to the intervention over time (Table 6). If items from the appendix are used, the VFQ-25 developers would encourage users to incorporate all optional items for a given sub-scale. This strategy will enhance the comparability of results across studies.

Scoring

Scoring VFQ-25 with or without optional items is a two-step process:

- First, original numeric values from the survey are re-coded following the scoring rules outlined in Table 2. All items are scored so that a high score represents better functioning. Each item is then converted to a 0 to 100 scale so that the lowest and highest possible scores are set at 0 and 100 points, respectively. In this format scores represent the achieved percentage of the total possible score, e.g. a score of 50 represents 50% of the highest possible score.

- In step 2, items within each sub-scale are averaged together to create the 12 sub-scale scores. Table 3 indicates which items contribute to each specific sub-scale. Items that are left blank (missing data) are not taken into account when calculating the scale scores. Sub-scales with at least one item answered can be used to generate a sub-scale score. Hence, scores represent the average for all items in the sub-scale that the respondent answered.

Composite Score Calculation

To calculate an overall composite score for the VFQ-25, simply average the vision-targeted sub-scale scores, excluding the general health rating question. By averaging the sub-scale scores rather than the individual items we have given equal weight to each sub-scale, whereas averaging the items would give more weight to scales with more items.

Table 1. Item Number Translation from the 51-Item Field Test Version to the VFQ 25

S = retained in the VFQ-25, A = retained in the appendix should be used for the VFQ-39,

--- = deleted from the VFQ-25 & VFQ-39

Field Test Version Ques.#	Sub-scale	Status	VFQ-25 Ques. #	Field Test Version Ques.#	Sub-scale	Status	VFQ-25 Ques. #
1	general health	S	1	29	social fx	---	---
2	general health	A	A1	30	social fx	A	A9
3	general vision	S	2	31	social fx	S	13
4	expectations	---	---	32	distance vision	A	A8
5	well-being/ distress	S	3	33	distance vision	A	A7
6	well-being/ distress	---	---	34	distance vision	S	14
7	ocular pain	S	19	35	driving (filter item)	S	15
8	expectations	---	---	35a	driving (filter item)	S	15a
9	expectations	---	---	35b	driving (filter item)	S	15b
10	expectations	---	---	35c	driving	S	15c
11	well-being/ distress	S	25	36	driving	---	---
12	ocular pain	S	4	37	driving	S	16
13	well-being/ distress	---	---	38	driving	S	16a *
14	general vision	A	A2	39a	role limitations	S	17
15	near vision	S	5	39b	role limitations	A	A11a
16	near vision	A	A3	39c	well-being/ distress	---	---
17	near vision	S	6	39d	role limitations	---	---
18	near vision	---	---	39e	role limitations	A	A11b
19	near vision	S	7	39f	role limitations	S	18
20	distance vision	S	8	40	well-being/ distress	A	A12
21	distance vision	---	---	41	dependency	S	20
22	distance vision	S	9	42	well-being/ distress	S	21
23	peripheral vision	S	10	43	well-being/ distress	S	22
24	distance vision	A	A6	44	dependency	---	---
25	social fx	S	11	45	dependency	A	A13
26	near vision	A	A4	46	dependency	S	23
27	color vision	S	12	47	dependency	S	24
28	near vision	A	A5				

* VFQ-25 item 16a was listed in previous versions as part of the appendix of supplemental items (#A10).

Table 2. Scoring Key: Recoding of Items

Item Numbers	Change original response category [a]	To recoded value of:
1,3,4,15c[b]	1	100
	2	75
	3	50
	4	25
	5	0
2	1	100
	2	80
	3	60
	4	40
	5	20
	6	0
5,6,7,8,9,10,11,12,13,14,16,16a	1	100
A3,A4,A5,A6,A7,A8,A9[c]	2	75
	3	50
	4	25
	5	0
	6	*
17,18,19,20,21,22,23,24,25,	1	0
A11a,A11b,A12,A13	2	25
	3	50
	4	75
	5	100
A1,A2	0	0
	to	to
	10	100

[a] Precoded response choices as printed in the questionnaire.

[b] Item 15c has four-response levels, but is expanded to a five-levels using item 15b.
Note: If 15b=1, then 15c should be recoded to "0"
If 15b=2, then 15c should be recoded to missing.
If 15b=3, then 15c should be recoded to missing.

[c] "A" before the item number indicates that this item is an optional item from the Appendix. If optional items are used, the NEI-VFQ developers encourage users to use all items for a given sub-scale. This will greatly enhance the comparability of sub-scale scores across studies.

* Response choice "6" indicates that the person does not perform the activity because of non-vision related problems. If this choice is selected, the item is coded as "missing."

Table 3. Step 2: Averaging of Items to Generate VFQ-25 Sub-Scales

Scale	Number of items	Items to be averaged (after recoding per Table 2)
General Health	1	1
General Vision	1	2
Ocular Pain	2	4, 19
Near Activities	3	5, 6, 7
Distance Activities	3	8, 9, 14
Vision Specific:		
Social Functioning	2	11, 13
Mental Health	4	3, 21, 22, 25
Role Difficulties	2	17, 18
Dependency	3	20, 23, 24
Driving	3	15c, 16, 16a
Color Vision	1	12
Peripheral Vision	1	10

Table 4. Step 2: Averaging of Items to Generate VFQ-39 Sub-Scales (VFQ-25 + Optional Items)

Scale	Number of items	Items to be averaged (after recoding per Table 2)
General Health	2	1, A1
General Vision	2	2, A2
Ocular Pain	2	4, 19
Near Activities	6	5, 6, 7, A3, A4, A5
Distance Activities	6	8, 9, 14, A6, A7, A8
Vision Specific:		
Social Functioning	3	11, 13, A9
Mental Health	5	3, 21, 22, 25, A12
Role Difficulties	4	17, 18, A11a, A11b
Dependency	4	20, 23, 24, A13
Driving	3	15c, 16, 16a
Color Vision	1	12
Peripheral Vision	1	10

Figure 1. Example of VFQ-25 Scoring Algorithm for Near Activities Sub-Scale

5. How much difficulty do you have reading ordinary print in newspapers? Would you say you have:

No difficulty at all 1
A little difficulty 2
Moderate difficulty 3
Extreme difficulty ..... **(4)**
Stopped doing this because of your eyesight 5
Stopped doing this for other reasons or not
interested in doing this 6

6. How much difficulty do you have doing work or hobbies that require you to see well up close, such as cooking, sewing, fixing . . . ? Would you say you have:

No difficulty at all ..... **(1)**
A little difficulty 2
Moderate difficulty 3
Extreme difficulty 4
Stopped doing this because of your eyesight 5
Stopped doing this for other reasons or not
interested in doing this 6

7. Because of your eyesight, how much difficulty do you have finding something on a crowded shelf? Would you say you have:

No difficulty at all 1
A little difficulty 2
Moderate difficulty 3
Extreme difficulty ..... **(4)**
Stopped doing this because of your eyesight 5
Stopped doing this for other reasons or not
interested in doing this 6

Scoring example - Figure 1

Items 5, 6, and 7 are used to generate the near activities sub-scale score (Table 3). Each of the items has 6 response choices. Response choice 6 indicates that the respondent does not perform the activity because of reasons that are unrelated to vision. If a respondent selects this choice, the answer is treated as missing and an average of the remaining items is calculated. Response choice 5 indicates that an activity is so difficult that the participant no longer performs the activity. This extremely poor near vision response choice is recoded to "0" points before taking an average of all three items. To score all items in the same direction, Table 2 shows that responses 1 through 5 for items 5, 6, and 7 should be recoded to values of 100, 75, 50, 25, and 0 respectively. If the respondent is missing one of the items, the person's score will be equal to the average of the two non-missing items.

Formula:

$$\text{Mean} = \frac{\text{(Score for each item with a non-missing answer)}}{\text{Total number of items with non-missing answers}}$$

Example:

$$\text{With responses converted: } = \frac{(25 + 100 + 25)}{3} = 50$$

Note: 100 = Best, 0 = Worst possible score.

Psychometric properties of VFQ-25 sub-scales

Psychometric data for VFQ-25 reported in the earlier pre-publication version of the scoring manual have been updated and submitted for peer-reviewed publication.[2] The values reported in this document are identical to those reported in the future publication and should be used when citing the performance characteristics of the VFQ-25.

Statistical Power Calculations

Tables 8, 9, and 10 are provided to estimate statistical power when using the VFQ-25 and VFQ-39. These tables estimate the number of subjects needed per group to attain 80% power (alpha = 0.05, two-tailed) depending on the anticipated difference in scores between groups. Table 8 contains power calculations for changes over time between two experimental (i.e. randomized) groups using a repeated-measures design. For example, if one were interested in being able to detect a 5-point difference for the VFQ-25 General Vision sub-scale, one would need 271 subjects per group. Table 9 shows power calculations for two experimental groups using a single, post-intervention measurement design. Such a design is not as precise as a design that uses a baseline and post-intervention measurement points (i.e., more subjects are needed per group to detect the same difference). Table 10 provides corresponding sample size information for a non-experimental (i.e. non-randomized) repeated-measures design where subjects self-select into the two groups. One sees that the number of subjects needed per group is more than that needed for a randomized experiment (Table 8) and less than the number needed for a randomized, post-intervention-only measurement design (Table 9).

Table 8. Sample sizes needed per group to detect differences in *change over time* between two experimental groups for the VFQ-25, repeated measures design

		Number of Points Difference			
Scale Name	SD	2	5	10	20
VFQ-25:					
General Health	26.00	1696	271	68	17
General Vision	21.00	1106	177	44	11
Ocular Pain	17.00	725	116	29	7
Near Activities	29.00	2110	338	84	21
Distance Activities	29.00	2110	338	84	21
Social Functioning	27.00	1829	293	73	18
Mental Health	27.00	1829	293	73	18
Role Difficulties	29.00	2110	338	84	21
Dependency	28.00	1967	315	79	20
Driving	35.00	3073	492	123	31
Color Vision	23.00	1327	212	53	13
Peripheral Vision	27.00	1829	293	73	18
VFQ-25 Composite	20.00	1004	161	40	10
VFQ-39:					
General Health	21.00	1106	177	44	11
General Vision	19.00	906	145	36	9
Ocular Pain	17.00	725	116	29	7
Near Activities	28.00	1967	315	79	20
Distance Activities	26.00	1696	271	68	17
Social Functioning	25.00	1568	251	63	16
Mental Health	26.00	1696	271	68	17
Role Difficulties	28.00	1967	315	79	20
Dependency	27.00	1829	293	73	18
Driving	35.00	3073	492	123	31
Color Vision	23.00	1327	212	53	13
Peripheral Vision	27.00	1829	293	73	18
VFQ-39 Composite	21.00	1106	177	44	11

Note: Scales are all scored on 0-100 possible range. Estimates assume alpha = 0.05, two-tailed t-test, power = 80%, and an inter-temporal correlation between scores of 0.60.

Table 9. Sample sizes needed per group to detect differences between two experimental groups for the VFQ-25, *post-intervention measures only.*

Scale Name	SD	Number of Points Difference 2	5	10	20
VFQ-25:					
General Health	26.00	2650	424	106	26
General Vision	21.00	1729	277	69	17
Ocular Pain	17.00	1133	181	45	11
Near Activities	29.00	3297	527	132	33
Distance Activities	29.00	3297	527	132	33
Social Functioning	27.00	2858	457	114	29
Mental Health	27.00	2858	457	114	29
Role Difficulties	29.00	3297	527	132	33
Dependency	28.00	3073	492	123	31
Driving	35.00	4802	768	192	48
Color Vision	23.00	2074	332	83	21
Peripheral Vision	27.00	2858	457	114	29
VFQ-25 Composite	20.00	1568	251	63	16
VFQ-39:					
General Health	21.00	1729	277	69	17
General Vision	19.00	1415	226	57	14
Ocular Pain	17.00	1133	181	45	11
Near Activities	28.00	3073	492	123	31
Distance Activities	26.00	2650	424	106	26
Social Functioning	25.00	2450	392	98	25
Mental Health	26.00	2650	424	106	26
Role Difficulties	28.00	3073	492	123	31
Dependency	27.00	2858	457	114	29
Driving	35.00	4802	768	192	48
Color Vision	23.00	2074	332	83	21
Peripheral Vision	27.00	2858	457	114	29
VFQ-39 Composite	21.00	1729	277	69	17

Note: Scales are all scored on 0-100 possible range. Estimates assume alpha = 0.05, two-tailed t-test, and power = 80%.

Table 10. Sample sizes needed per group to detect differences between two *self-selected groups* for the VFQ-25, repeated measures design

		Number of Points Difference			
Scale Name	SD	2	5	10	20
VFQ-25:					
General Health	26.00	2120	339	85	21
General Vision	21.00	1383	221	55	14
Ocular Pain	17.00	906	145	36	9
Near Activities	29.00	2637	422	105	26
Distance Activities	29.00	2637	422	105	26
Social Functioning	27.00	2286	366	91	23
Mental Health	27.00	2286	366	91	23
Role Difficulties	29.00	2637	422	105	26
Dependency	28.00	2459	393	98	25
Driving	35.00	3842	615	154	38
Color Vision	23.00	1659	265	66	17
Peripheral Vision	27.00	2286	366	91	23
VFQ-25 Composite	20.00	1254	201	50	13
VFQ-39:					
General Health	21.00	1383	221	55	14
General Vision	19.00	1132	181	45	11
Ocular Pain	17.00	906	145	36	9
Near Activities	28.00	2459	393	98	25
Distance Activities	26.00	2120	339	85	21
Social Functioning	25.00	1960	314	78	20
Mental Health	26.00	2120	339	85	21
Role Difficulties	28.00	2459	393	98	25
Dependency	27.00	2286	366	91	23
Driving	35.00	3842	615	154	38
Color Vision	23.00	1659	265	66	17
Peripheral	27.00	2286	366	91	23
VFQ-39 Composite	21.00	1383	221	55	14

Note: Scales are all scored on 0-100 possible range.Estimates assume alpha = 0.05, two-tailed t-test, power = 80%, and an inter-temporal correlation between scores of 0.60.

Frequently Asked Questions (FAQ)

Q. *What kind of permissions are required to use the VFQ-25 in a research study?*

The VFQ-25 is a public document available without charge for all researchers to use provided they identify the measure as such in all publications and cite the appropriate developmental papers. Users do not need to notify the developers or the NEI that they intend to use the measure. However, there are some specific permissions for using the VFQ-25 that are detailed on the cover page of the questionnaire itself. These include acknowledging in all publications that the VFQ-25 was developed by RAND and funded by the NEI, and that any changes made to the measure for your particular study will be identified as such.

Q. *Can I change the format of the VFQ-25 to suit my study?*

Any change to the wording or order of the items would constitute a change to the measure and should be specified as such in any published papers. Other than this, it is expected that researchers may need to change the format or appearance of items to suit their purposes.

As of August 2000, to our knowledge no studies have reported on the effect of item order on responses to VFQ-25 or other similar vision-targeted surveys. That is, whether responses change depending where particular items appear in the questionnaire. However, to ensure the comparability of scores across studies, it is our position that the order of items should not be changed.

Q. Has the VFQ-25 been translated into any other languages?

As of August 2000, the developers are aware of translation into approximately 9 languages. For the cost of distribution, a Spanish language version for Mexican-American populations is available from the UCLA and RAND based developers. The developers will provide researchers with the names of other persons to contact for other language translations. Should researchers wish to translate the VFQ-25, the same permissions apply, with the additional requirement that all publications specify responsibility for the translation along with instructions for obtaining a copy of the translated version.

Q. Do you have any additional normative information for specific populations?

The developers currently are not conducting studies for the express purpose of further investigating the psychometric properties of the VFQ-25 or producing normative data. However, many researchers are currently using the VFQ-25 as an endpoint or outcome in a number of health services and clinical studies. It is likely that as these studies are completed, results that are relevant to better understanding the performance of the VFQ-25 will accompany the main results of each study. The developers and staff at the NEI are aware of other researchers who are collecting condition-specific normative data on population-based samples with the VFQ-25 and when possible will provide contact information for these investigators to new users.

Q. How relevant is the normative data provided in the scoring manual to my sample?

The means, standard deviations, and statistical power values shown in this document were estimated using cross-sectional data from the Field Test Study. Participants recruited for the Field Test were not randomly sampled, but rather were identified for enrollment based on clinical criteria biased towards persons with moderate to severe forms of each target disease. Further, because it was our desire to enroll a broad spectrum of patients based on disease severity, we did not take into consideration treatment status. Please see references #3 for a full description of the NEI-VFQ field test study sample.

Q. Why is a single-item general health item included in the VFQ-25?

During the developmental phase of the NEI-VFQ, vision-targeted health-related quality of life (HRQOL) was a relatively new concept. For this reason, we included this question to insure that researchers had a minimal amount of information about a person's general health status to use as a benchmark against other published samples or cohorts.

This general health rating question has been widely used in studies and is a robust predictor of future health and mortality. However, to fully measure generic HRQOL, many quality of life measurement experts recommend including a separate generic measure of HRQOL such as the SF-36 or SF-12.[9] In such a situation the single-item VFQ-25 general health rating question is not needed because the identical question is asked as part of these surveys.[10, 11]

Q. Should we be looking at the sub-scales or the composite score?

The VFQ-25 sub-scales are grouped by theme or domain. So, for example, items having to do with near vision are differentiated from items having to do with other vision activities like distance vision or ocular pain. This does not mean that the items are not highly correlated or that they are psychometrically distinct. What it does mean is that researchers should beforehand carefully consider which vision-specific domains are most likely to be influenced by a particular disease and/or treatment and then focus on the results from those sub-scales to support their findings.

The composite score is best used in situations where an overall measure of vision-targeted health related quality of life is desired. For example, in studies where it is not clear what the specific impact of ocular disease or a new treatment might be. Also, in situations where differences can be hypothesized between groups beforehand across multiple sub-scales but the overall sample size of the study is relatively small, because it is likely that the error term for the composite score is likely to be smaller than for any given sub-scale, it may be more efficient to represent these differences as a single score.

Q. What benefit is there to using the VFQ-25 over a measure more specific to a particular disease, like the Activity of Daily Vision Scale (ADVS)[10] for persons with age-related cataracts?

The VFQ-25 contains items that are very similar to items found in other vision-targeted measure like the ADVS that are more task oriented. However, whereas the ADVS was designed specifically to assess a set of activities most relevant to patients undergoing cataract surgery, the VFQ-25 expands the range of activities to measure the impact of ocular disease on broader domains of health such as social and emotional well-being. Serious ocular diseases that lead to irreversible loss of vision are likely to impact dimensions of a person's life beyond simple tasks such as driving or reading the newspaper, and similarly, by preserving vision, many successful interventions also will impact persons' lives at this more global level. Especially in these situations, use of the VFQ-25 should be considered.

Q. Why does the response to item 15b, "stopped driving due to vision and other reasons", generate a missing score for the subsequent driving items?

Driving items 15, 15a, and 15b are filter questions designed to specify whether a person has ever driven a car, and if so, whether they are currently driving or if they have stopped. If people have never driven a car, then, of course, their answers should be set to missing for all driving items. Similarly, this also applies to people who have stopped driving for other reasons not due to vision. However, in the course of pilot testing the field test participants wanted this additional mixed response option. It was our decision that although persons did indeed report not driving due to vision, it was not clear how much of a role the "other" reason also played in this decision. Therefore, we set

the scoring criteria for this response to be missing for all subsequent driving items to be absolutely sure that all driving responses reflected only problems with vision. Should researchers wish to change this response option to allow persons to answer subsequent driving items (currently there is a skip to item #17), this change should be noted in subsequent publications.

References

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Attachments include:

NEI VFQ-25 (IA = Interviewer-Administered format)
(SA = Self-Administered format)