

## Perspectives in Ophthalmology

# Optometric practice in Norway: a cross-sectional nationwide study

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### ABSTRACT.

**Purpose:** To describe optometric practitioners and their encountering patients.

**Methods:** All members of the Norwegian Association of Optometrists working in the community ( $n = 761$ ) were invited to participate in a questionnaire survey; questionnaire responders ( $n = 508$ ) were asked to take part in a practice registration. Data collection was carried out between November 2004 and May 2005 using a questionnaire and a practice registration form.

**Results:** Five hundred and eight optometrists responded to the questionnaire; of these 212 participated in the practice registration, in which 4052 patient encounters were recorded. All optometrists reported taking patient history in the areas of vision and ocular health; 55% asked questions about general health for all patients. More than 80% collaborated with general practitioners and ophthalmologists. The patient encounters were with 1699 men and 2216 women; 60% of patients were aged 45 years or older. Patients reported a history of ocular disease and other conditions of relevance for ocular health in 12% and 17% of encounters, respectively. One per cent had low vision [best corrected visual acuity (BCVA)  $< 0.33$ ] and 2% were visually impaired (BCVA  $< 0.5$ ). Ophthalmoscopy was performed for 88% of patients; dilated fundus examinations were carried out for 2%; clinical findings of cataract were reported for 11%; and retinopathy was suspected in 3%. Six per cent of patients were referred to a general practitioner or ophthalmologist.

**Conclusion:** Optometrists generally collaborate with general practitioners and ophthalmologists. They take history, investigate and assess patients with ocular problems. A significant number of patients had primary or secondary ocular disease. This illustrates the role of optometrists as healthcare workers.

**Key words:** ocular disease – optometric practice – referral – routine examination – visual acuity – visual impairment

### Introduction

Optometry has developed from craftsmanship to a health profession. In Norway, this status was first secured in 1988 (Anonymous 1988). Since 1999, optometric practice has been regulated by the Health Personnel Act founded on the principles for responsible conduct.

Sixty-six per cent of the Norwegian population use vision correction (Liggard 2006), and Norwegian optometrists perform more than one million eye examinations per year (Lid et al. 1996). Reports from other countries indicate that between 2% and 14% of optometric examinations result in referral to other healthcare providers, depending on the nature of optometric practice (Brin & Griffin 1995). In a small Norwegian study, 4% of the patients seen by optometrists were referred to other healthcare providers (Lid et al. 1996). Riise et al. (2000) assessed optometrists' referrals to a hospital eye department and judged that 94% of the optometric referrals were clinically relevant. However, Norwegian research in this field is limited and we lack systematic knowledge regarding Norwegian optometric practice in the community. To the best of our knowledge, routine optometric practice has never been described

based on large studies with representative samples of optometrists and their patients.

The aim of this study was to describe optometric practice and the characteristics of the encountering patients based on a nationwide, representative sample of optometrists.

## Materials and Methods

All members of the Norwegian Association of Optometrists (NOF) working in optometric practice in the community were invited to participate in a questionnaire survey, and the questionnaire responders were asked to take part in practice registration. Members working in institutions or industry were excluded, as were members who were retired, unemployed, on leave, not practising optometry, living abroad or with unknown residential address. Out of 1454 authorized optometrists, 1044 were members of NOF and 761 filled the inclusion criteria. Additionally, 29 practising non-member optometrists volunteered to participate, contributing to a total sample of 790.

Data collection was carried out between November 2004 and May 2005, using a questionnaire and a practice registration form. The questionnaire and registration form had been assessed in a pilot study. Reminders were sent twice. Data for non-responding optometrists' gender, age and health region of practice were provided by NOF and the Norwegian Registration Authority for Health Personnel.

In the questionnaire we asked about the nature of optometric practice, education and work experience, practice habits and opinions on important principles of practice. In the practice registration, each optometrist was to record details for 20 consecutive patients seen for a full eye examination. Patient history, best corrected visual acuity (BCVA), ocular health and further management (e.g. referral) were recorded. Ocular disease was defined as a positive history of cataract, glaucoma and/or age-related macular degeneration, and cataract and/or suspected retinopathy on clinical examination. We also recorded data of systemic diseases that commonly affect ocular health (diabetes,

hypertension and cardiovascular disease). Low vision and blindness were defined by the World Health Organization's criteria (WHO 1973) (BCVA in the better eye  $< 0.33$  and  $< 0.05$ , respectively); visual impairment was defined as BCVA in the better eye  $< 0.5$ .

The study followed the tenets of the Declaration of Helsinki for research involving humans. The study was not subject to the evaluation and approval of the Regional Committee for Medical Research Ethics (Haug 2004, personal communication); however, the Norwegian Social Science Data Services were notified prior to commencement. Data were analysed with standard statistical methods.

## Results

Five hundred and eight optometrists responded to the questionnaire survey. Table 1 shows the characteristics of the optometrists. Female and younger optometrists responded more frequently than male and older optometrists ( $P < 0.001$ ). Two hundred and twelve of the 508 responders participated in practice registration. Most optometrists participating in practice registration had 3 years or more of higher education and worked in practices with population  $< 50\,000$  ( $P < 0.001$ ).

All optometrists reported taking patient history of vision and ocular health as part of the routine consultation; 55% asked questions about general health for all patients. Table 2 shows diagnostic investigations included in routine optometric examination. More practice registration participants reported performing ophthalmoscopy as part of routine examination ( $P = 0.006$ ) than non-participants, and they graded their fundus evaluation skills higher ( $P = 0.038$ ).

More than 80% of the optometrists collaborated with general practitioners and ophthalmologists. Table 3 shows optometrists' collaboration with general practitioners and ophthalmologists. More practice registration participants sent reports to ( $P = 0.02$ ) and received referrals from ( $P = 0.025$ ) general practitioners than non-participants; also, practice registration participants received patient

reports from ophthalmologists ( $P = 0.006$ ) more commonly than non-participants. More reports ( $P = 0.004$ ) and referrals ( $P < 0.001$ ) were sent to general practitioners than to ophthalmologists, whereas more telephone consultations/referrals were made to ophthalmologists ( $P < 0.001$ ). Patient reports were more common from ophthalmologists than from general practitioners ( $P < 0.001$ ).

In total, 4052 patient encounters were recorded; the mean number of patient encounters recorded was 19 (range 2–20). The average number of patients seen by the optometrists per week, including contact lens consultations, was 40 ( $SD \pm 19$ , range 0–150); the average number of routine optometric examinations was 21 ( $SD \pm 11$ , range 0–70). Ophthalmoscopy was performed for 88% of the encounters, of which 2% were dilated fundus examinations.

Table 4 shows the characteristics of the patients. The majority of patients were 35 years or older. Visual acuity was best in the working age group and was poorer among older patients. One per cent of the patients had low vision (BCVA  $< 0.33$ ) and 2% were visually impaired (BCVA  $< 0.5$ ). Figure 1 shows age-distributed best corrected visual acuity for the encounters.

Based on ocular and medical history, 12% had ocular disease; 17% had systemic disease of ocular relevance. Twenty-four per cent had known ocular or systemic disease. The optometrist reported clinical findings of cataract in 11% of patients and retinopathy was suspected in 3%. Six per cent of the encounters were referred. The receiver of the referral was known for half of the referrals; 72% were to a general practitioner and 25% to an ophthalmologist. Table 5 gives an overview of patient referrals.

## Discussion

To our knowledge this is the first national cross-sectional description of optometric practice to date. The sample was recruited from members of NOF; mean age and sex distribution were similar for members and non-members of NOF. The participation rate was fairly good – 65% answered

**Table 1.** Characteristics of optometrists as reported by optometrists in the questionnaire ( $n = 508$ ) and as registered by the Norwegian Optometric Association and the Norwegian Registration Authority for Health Personnel [ $n$  (%)].

Optometrist characteristics	Participants in practice registration* ( $n = 212$ )	Non-participants in practice registration* ( $n = 296$ )	All responders* ( $n = 508$ )	Non-responders† ( $n = 282$ )
Sex‡ ( $n = 505/280$ )				
Male	90 (42.9)	149 (50.5)	239 (47.3)	184 (65.7)
Female	120 (57.1)	146 (49.5)	266 (52.7)	96 (34.3)
Optometrist age‡ ( $n = 504/280$ )				
≤ 30 years	71 (33.9)	75 (25.4)	146 (29.0)	44 (15.7)
31–40 years	84 (40.2)	124 (42.0)	208 (41.3)	80 (28.6)
41–50 years	43 (20.6)	59 (20.0)	102 (20.2)	66 (23.6)
> 50 years	11 (5.3)	37 (12.5)	48 (9.5)	90 (32.1)
Health region of practice ( $n = 503/280$ )				
East	73 (34.8)	97 (33.1)	170 (33.8)	104 (37.1)
South	51 (24.3)	66 (22.5)	117 (23.3)	60 (21.4)
West	44 (21.0)	62 (21.2)	106 (21.1)	54 (19.3)
Middle	15 (7.1)	46 (15.7)	61 (12.1)	35 (12.5)
North	27 (12.9)	22 (7.5)	49 (9.7)	27 (9.6)
Education§ ( $n = 505$ )				
Technical college	6 (2.9)	29 (9.8)	35 (6.9)	
2 years university college	31 (14.8)	58 (19.6)	89 (17.6)	
3 years university college	128 (61.2)	159 (53.7)	287 (56.8)	
MSc‡	44 (21.1)	50 (16.9)	94 (18.6)	
Number of years in optometric practice ( $n = 503$ )				
≤ 5 years	75 (35.7)	79 (26.8)	152 (30.2)	
6–10 years	47 (22.4)	62 (21.0)	109 (21.7)	
11–20 years	54 (25.7)	94 (31.9)	148 (29.4)	
≥ 21 years	34 (16.2)	60 (20.3)	94 (18.7)	
Area of workplace§ ( $n = 503$ )				
City of population	83 (39.9)	133 (45.1)	216 (42.9)	
> 50 000				
City of population	74 (35.6)	96 (32.5)	170 (33.8)	
< 50 000				
Village	50 (24.0)	59 (20.0)	109 (21.7)	
More than one area of workplace	1 (0.5)	7 (2.4)	8 (1.6)	
Type of optometric practice ( $n = 504$ )				
Independent practice	49 (23.6)	80 (27.0)	129 (25.6)	
Member owned chain	127 (61.1)	155 (52.3)	282 (56.0)	
Centrally owned chain	26 (12.5)	51 (17.2)	77 (15.3)	
More than one type of optometric practice	6 (2.9)	10 (3.4)	16 (3.2)	

\* Data reported in questionnaire survey.

† Data from the Norwegian Optometric Association and the Norwegian Registration Authority for Health Personnel.

‡ Pearson Chi-squared  $P < 0.001$  between respondents and non-respondents to the questionnaire survey.§ Pearson Chi-squared  $P < 0.001$  between participants and non-participants in practice registration.

the questionnaire – and of these 42% participated in practice registration. In the questionnaire survey, the respondents were younger and more were female. In the practice registration more participants had 3 years or more of higher education and worked in communities of less than 50 000 inhabitants. Therefore, our results may overestimate the frequency of

ophthalmoscopy as part of the routine examination, use of referrals and prevalence of reported pathological observations. Data were registered for consecutive patients attending examination to limit patient selection bias. Possible limitations of data collection were the reliance on self-report and memory recall and the fact that practice registration may have influenced

**Table 2.** Examinations included in a routine optometric examination [ $n$  (%)] as reported by optometrists in the questionnaire ( $n = 506$ ).

Examinations included	All responders*
Refraction	506 (100)
Patient history	504 (99.6)
Ophthalmoscopy	467 (92.3)
Covertest	457 (90.3)
Tonometry depending on age	444 (87.7)
Motility	288 (56.9)
Donders/confrontation fields	264 (52.2)
Screening of visual field on suspicion of field defect	242 (47.8)
Slitlamp examination of anterior segment	236 (46.6)
Amsler chart	63 (12.5)

\* Data missing for two optometrists.

the way in which the optometrists performed their routine examination. Neither quality of clinical examination nor accuracy of referrals with regard to tentative diagnosis and relevance were examined in the study.

In our study, 60% of patients were over 45 years old and more women than men were examined. Similar observations have been made in Australian optometric practice (Harris & Sampson 2005). Two per cent of patients recorded in our study were visually impaired (BCVA  $< 0.5$ ). This is in accordance with the estimated population prevalence for Western Europe (Congdon et al. 2004a), but is higher than the registered prevalence in Denmark (Buch et al. 2004). In patients aged over 65 years, epidemiological studies have reported prevalence of visual impairment (BCVA  $< 0.5$ ) of 2–8% (Tielsch et al. 1990; Klein et al. 1991; Attebo et al. 1996; Klaver et al. 1998; Bergman & Sjostrand 2002; Bergman et al. 2004; Buch et al. 2004). Using the same definition as these studies, we found similar prevalence. In the working age groups, 1% met the criteria for low vision (BCVA  $< 0.33$ ); this figure is higher than that found by epidemiological studies (Nissen et al. 2003). Visual loss is an important factor of functional impairment (West et al. 1997), and the National Health and Nutrition Examination Survey reported that 84% of visual impairment in the USA was the result of uncorrected refractive errors (Vitale et al. 2006). Hence, regular eye

**Table 3.** Collaboration with other healthcare providers [*n* (%)] as reported by optometrists (*n* = 508) in the questionnaire.

	Optometrist collaboration with:	
	General practitioner	Ophthalmologist
No collaboration	93 (18.3)	88 (17.3)
Refer/confer by telephone*	102 (20.1)	272 (53.5)
Send reports†	246 (48.4)	200 (39.4)
Send referrals*	421 (82.9)	336 (66.1)
Receive patient reports*	121 (23.8)	331 (65.1)
Receive referrals	128 (25.2)	118 (23.2)
Joint practice*	6 (1.2)	53 (10.4)

Pearson Chi-square \**P* < 0.001, †*P* = 0.004 between collaboration with general practitioner and ophthalmologist.

examination is important to avoid unnecessary functional impairment. Moreover, regular eye examinations promote early detection of ocular disease, and timely treatment can prevent visual loss and preserve independent living.

Our study found a prevalence of 4% for both glaucoma and age-related macular degeneration (AMD) in patients aged over 40 years; this is higher than the estimated prevalence in Western Europe (Friedman et al. 2004a, 2004b). In contrast, the prevalence

of cataract was lower than the 19% estimated for Western Europe (Congdon et al. 2004b). This discrepancy in prevalence between the general population and optometric practice may reflect that cataract usually leads the patient to an ophthalmologist for cataract evaluation and cataract extraction. Glaucoma and AMD, often with slowly progressing symptoms, are more likely to be seen in optometric practice by chance. Moreover, having an ocular disease such as glaucoma or AMD may increase awareness of the importance of regular examination of vision and ocular health.

In a cross-sectional study, 70% of undiagnosed eye diseases were found in 60–79-year-olds (Keefe et al. 2002). In our study, 47% of the cataracts disclosed were previously unknown. Suspected retinopathies were found in

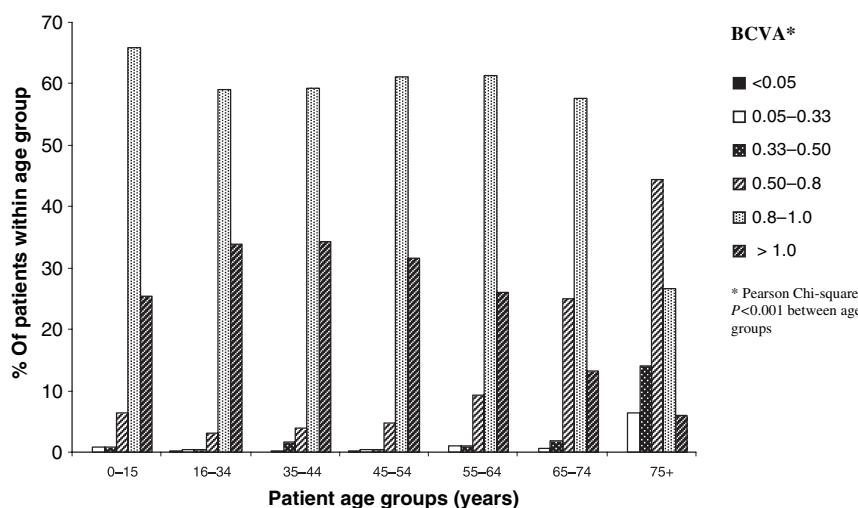
**Table 4.** Relevant history, examination and findings in age groups for 4052 consecutive optometric consultations undertaken by 212 optometrists, and comparison of the patients with the Norwegian population [*n* (%)].

	<i>n</i>	All groups	0–15	16–34	35–44	45–54	55–64	65–74	75+
Age distribution									
In the Norwegian population*	4 640 219		(19.5)	(25.8)	(14.9)	(13.4)	(11.6)	(7.0)	(7.7)
In patients seen in optometric practice	4041		326 (8.1)	792 (19.6)	543 (13.4)	874 (21.6)	661 (16.4)	426 (10.5)	419 (10.4)
Sex distribution†									
Male	1699		150 (8.9)	307 (18.1)	222 (13.1)	382 (22.6)	283 (16.7)	179 (10.6)	170 (10.0)
Female	2216		165 (7.5)	457 (20.7)	304 (13.7)	461 (20.8)	356 (16.1)	229 (10.4)	240 (10.8)
Ocular and medical history									
Cataract	371 (9.2)		1 (0.3)	8 (1.0)	7 (1.3)	26 (3.0)	46 (7.0)	91 (21.4)	188 (44.9)
Glaucoma	109 (2.7)		0 (0.0)	1 (0.1)	6 (1.1)	22 (2.5)	19 (2.9)	25 (5.9)	36 (8.6)
Age-related macular degeneration	99 (2.4)		0 (0.0)	1 (0.1)	1 (0.2)	3 (0.3)	11 (1.7)	18 (4.2)	63 (15.0)
Hypertension	439 (10.8)		0 (0.0)	6 (0.8)	17 (3.1)	65 (7.4)	123 (18.6)	113 (26.5)	110 (26.3)
Cardiovascular disease	238 (5.9)		2 (0.6)	4 (0.5)	5 (0.9)	15 (1.7)	44 (6.7)	63 (14.8)	105 (25.1)
Diabetes	166 (4.1)		4 (1.2)	16 (2.0)	16 (2.9)	22 (2.5)	39 (5.9)	34 (8.0)	35 (8.4)
Family history of diabetes	302 (7.5)		20 (6.1)	42 (5.3)	41 (7.6)	74 (8.5)	63 (9.5)	36 (8.5)	25 (6.0)
Clinical findings of ocular disease and risk factors									
Do not meet visual criteria for driving (BCVA‡ < 0.5)	99 (2.4)		3 (0.9)	9 (1.2)	3 (0.6)	8 (0.9)	11 (1.7)	7 (1.7)	57 (13.7)
Low vision (BCVA‡ < 0.33)	54 (1.3)		3 (0.9)	6 (0.8)	1 (0.2)	5 (0.5)	8 (1.2)	3 (0.7)	28 (6.7)
Blind (BCVA‡ < 0.05)	4 (0.1)		0 (0.0)	2 (0.3)	0 (0.0)	2 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)
Cataract	442 (10.9)		1 (0.3)	4 (0.5)	3 (0.6)	24 (2.7)	70 (10.6)	119 (27.9)	218 (52.0)
Suspected retinopathy	116 (2.9)		0 (0.0)	2 (0.3)	3 (0.6)	13 (1.5)	20 (3.0)	22 (5.2)	56 (13.4)
Ocular hypertension (IOP§ > 21 mmHg)	121 (4.9)		4 (1.4)	3 (0.2)	10 (3.2)	27 (3.8)	36 (6.3)	25 (7.1)	16 (4.8)
Fundus examination and referral									
Ophthalmoscopy part of the examination¶	3576 (88.3)		245 (75.2)	600 (75.8)	486 (86.2)	819 (93.7)	630 (95.3)	406 (95.3)	398 (95.0)
Ophthalmoscopy performed in mydriasis¶	78 (2.2)		7 (2.9)	3 (0.5)	6 (1.3)	21 (2.6)	13 (2.1)	8 (2.0)	20 (5.0)
Referred to general practitioner or ophthalmologist	258 (6.4)		8 (2.5)	20 (2.5)	13 (2.4)	33 (3.8)	40 (6.1)	54 (12.7)	86 (20.6)

BCVA, best corrected visual acuity; IOP, intraocular pressure.

\*Statistics Norway, 1 January 2006.

Missing data for †137, ‡45, §1575, ¶10 patients.



**Fig. 1.** Best corrected visual acuity according to age among 4041 patients seen in Norwegian optometric practice.

3% of patients, and more than 50% of these patients had no reported history of ocular or systemic disease. This substantiates the claim that optometrists have a role to play in case-finding of patients with relevant systemic disease. It was beyond the scope of this study to assess the quality of the tentative diagnoses, and this should be

addressed in future research. However, the observed prevalence is high and may suggest low diagnostic specificity. Problems related to low specificity must be weighed against the risks of not having detected a potentially serious systemic disease. However, low specificity induces a higher than necessary use of health services and may scare patients unnecessarily. Measures should be taken to reduce these side effects. Early, precise diagnosis is preferable, and referral directly from optometrist to ophthalmologist is one way of achieving this.

The number of referrals in our study was higher than previously reported (Lid et al. 1996). The reported referral patterns corresponded well with those of UK optometrists (Lash 2003). We did not investigate the relevance of the referrals. However, a previous Norwegian study concluded that 94% of referrals from Norwegian optometrists were clinically relevant. The same study estimated that 27 000 consultations by general practitioners could be avoided by direct referral from optometrist to ophthalmologist (Riise et al. 2000). Historically, optometrists have referred patients directly to ophthalmologists. We found that the majority of referrals were sent to a general practitioner. One explanation for this may be the implementation of the list system in Norwegian general practice in 2001, which demands that referral to a specialist is made by the patient's general practitioner. We question whether the

**Table 5.** Patient management and referrals in 4052 optometric consultations, undertaken as consecutive consultations by 212 optometrists [n (%)].

Patient management and referral characteristics	All patients
Patient management (n = 4052)	
None or routine follow-up	3593 (88.7)
Referral sent	258 (6.4)
Report sent	113 (2.8)
Patient asked to contact general practitioner	88 (2.2)
Receiver of referral (n = 129)	
General practitioner	93 (72.1)
Ophthalmologist	32 (24.8)
Casualty	4 (3.1)
Referral cause* (n = 128)	
Visual acuity	54 (42.8)
Anterior segment (including cataract)	44 (34.4)
Intraocular pressure	24 (18.8)
Retinopathy	17 (13.3)
Maculopathy	14 (10.9)
Headache	10 (7.8)
Binocular vision	4 (3.1)
Other causes	35 (27.3)

\* Some patients were referred due to more than one cause.

formal referral road from an optometrist to an ophthalmologist always needs to pass the general practitioner. The possibility for an optometrist to refer patients directly to an ophthalmologist should be considered.

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