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An overview of optometrists' diabetic retinopathy practice patterns – a cross-sectional survey

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A survey of optometrists' practice patterns in DR

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Abstract:

Purpose: Contemporary eye care increasingly recommends the use of advanced retinal imaging technology. Anecdotal evidence suggests that this equipment is widely available in primary eye care settings; however, knowledge regarding how optometrists use this equipment in the context of diabetic retinopathy (DR) is limited. This study aimed to obtain a current overview of optometrists' clinical practice behaviours in the detection, screening, diagnosis and management of patients with diabetes.

Methods: A cross-sectional survey was designed to evaluate optometrists' self-reported clinical practice patterns and perceptions, as well as the availability and impact of retinal imaging equipment specific to DR and diabetic macular oedema (DMO) on optometrists' clinical practice. The survey invited participation from all optometrists practising in Australia.

Results: One hundred and sixty-seven optometrists participated. Optometrists' self-reported confidence in assessing DR and DMO was high. Optometrists' referral patterns considered the severity of DR and DMO before initiating referral to secondary ophthalmology care. Nearly all optometrists (98.8 %) indicated that they had some form of retinal imaging equipment available to them in clinical practice. An optical coherence tomography (OCT) device was available to 75.5% of optometrists. A significant association between having an OCT device in the practice and higher self-reported confidence levels in the assessment of DMO was found.

Conclusions:

Many optometrists are well equipped with sophisticated retinal imaging technology for the provision of high-quality eye care. Enhancing optometric training and education programmes can maximise

the community benefit of access to this equipment and improve delivery of eye care in the community.

Introduction:

Diabetic retinopathy (DR) is a common complication of diabetes and is the leading cause of acquired visual impairment in the working age population.¹ The prevalence of DR is approximately one in three among individuals with diabetes, with one in 10 persons expected to have a vision-threatening form of the disease.² Global estimates of diabetes are expected to grow from 451 million individuals in 2017 to 693 million by the year 2045.¹ Moreover, within the first two decades of diagnosis, DR is likely to affect nearly all patients with diabetes.^{3, 4}

Timely detection and treatment of vision-threatening DR can prevent vision loss.⁵⁻⁷ Thus, current approaches addressing the public health burden of DR involve widespread community screening, early detection of retinal vascular lesions, regular follow-up and prompt treatment of vision-threatening DR.^{8, 9} In Australia, optometrists and ophthalmologists are the key workforce involved in the delivery of eye care. Optometrists are trained to identify fundoscopic signs of DR and triage management. At the time of this study, there were approximately 5,600 optometrists practising in Australia¹⁰, providing 75% of ocular health examinations nationwide.¹¹ They are well positioned within the community to facilitate diabetic eye services.

General optometric practice in settings such as in the United Kingdom (UK), the United States of America (USA), Australia and New Zealand (NZ), has evolved with the expansion of traditional role boundaries, particularly in the areas of detection and treatment of ocular diseases.¹²⁻¹⁶ Optometrists are incorporated into public health systems or integrated into shared care models to facilitate delivery of eye care services at the community level to reduce the burden of care from the smaller, specialty ophthalmology workforce.^{12, 17, 18} In parallel with the expansion of optometric scope of practice, the development of novel ophthalmic imaging technologies has provided an aid and impetus for optometrists to improve their practices of assessment and management of DR.

Conventional retinal photography was introduced as an endpoint in clinical trials as early as the 1960s.¹⁹ In 1997, Australia's Clinical Practice Guidelines for the Management of DR, developed by the National Health and Medical Research Council (NHMRC), outlined retinal photography as a satisfactory means of screening and monitoring DR.²⁰ A 2012 survey of UK optometrists found that retinal cameras were the most widely used specialist equipment,²¹ corroborating findings from another survey published in 2011 which reported 55% of optometrists with retinal camera access.²²

Similar trends in accessibility are expected with optical coherence tomography (OCT).²³ First introduced in 1991²⁴ and successfully commercialised in 1996,²⁵ OCT is an important clinical diagnostic tool especially in the detection of diabetic macular oedema (DMO) and monitoring of DMO treatment responses in clinical trials.^{26, 27} More recently, OCT-angiography (OCT-A) has also gained popularity as a non-invasive alternative to contrast dye angiography.^{28, 29}

Notwithstanding the changing landscape of the optometric profession, current optometry practices in the assessment and management of DR and DMO are not well documented. This is in contrast to studies evaluating optometric practices in other areas of eye care such as glaucoma,^{30, 31} in addition to cross-sectional studies evaluating the profession's adoption of specialist equipment and technology in the UK.²¹ Whilst optometrists' attitudes and management patterns in assessment of DR and DMO have been studied, this was limited to the evaluation of implementation of clinical guidelines.^{22, 32} An overview of the scope of optometric practice in Australia conducted in 2015¹⁶ only briefly commented on diabetic eye care.

Here we report the results of a cross-sectional survey evaluating Australian optometrists' DR management practices and imaging tools, as well as optometrists' perceptions of these tools. Our study seeks to provide an evidence-base to support optometric education and professional development activities, and to evaluate the need for updated guidelines for the management of diabetic eye disease by optometrists.

Methods:

This cross-sectional study was approved by The University of Melbourne Human Research Ethics Committee (Ethics ID: 1954439.1) and adhered to the tenets of the Declaration of Helsinki. The reporting of methods and results has been complied with reference to the Checklist for Reporting Results of Internet E-Surveys (CHERRIES).³³

Participants and survey dissemination

We targeted registered Australian optometrists. There were no incentives in place for potential respondents and participation was voluntary, resulting in a convenience sample. The survey was launched during the 2019 regional conference based in Victoria, which was available for attendance to national and international audiences (approximately 1,100 optometry delegates) in July. The survey was primarily distributed via an online webpage hosted by Qualtrics^{XM} (www.qualtrics.com/), with the option of a hard-copy format available. The survey was active for approximately three months. During this time, professional optometry groups (Optometry Australia,

Early Career Optometrists, Department of Optometry and Vision Sciences at The University of Melbourne) advertised a web link to the survey via social media (Facebook, LinkedIn, Twitter). Paper-based advertisements containing the electronic survey link were also distributed at continuing professional development (CPD) events involving face-to-face engagement, as well as via physical noticeboards of optometry organisations.

Survey design and pre-testing

The study purpose, research team, estimated time commitment and data protection measures were summarised on the cover page. Data was anonymised and informed consent was obtained when respondents opted to commence the survey.

The questionnaire consisted of 27 items organised into seven main sections, provided in *Table 1*. These items spanned 11 pages for the electronic web-based link and eight pages for the paper-based survey; there was no consistent number of items per page / screen as survey questions and items were presented in a standardised unaltered order. Response types included five-point ordinal Likert-type scales, Yes/No/Unsure options and free text. One section was designed in a two item forced-choice format. There was a mix of mandatory and non-mandatory questions. Some adaptive questioning was included where questions were conditionally displayed depending on the participant's response. For example, for the section "Opinions and attitudes towards OCT in the context of DMO" (*Table 1*), respondents who answered that they had an OCT device available to them at their practice were presented with different questions than respondents who indicated no OCT device. Respondents could review their responses to previous questions so long as the survey had not yet been submitted.

The authors and five optometrists piloted the survey to assess its clarity and to estimate the time commitment required for completion. Minor amendments were made based on feedback received during the pilot. Individuals involved in the pilot did not respond to the final survey. View and participation rates were not retrieved.

Section / Category	Question number	Question surveyed
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Confidence with diagnosis, detecting and management of DR and DMO	1 – 4	Self-reported confidence at grading the severity of patient's DR, confidence at managing (either reviewing or referring) patient's DR, confidence at detecting DMO and confidence at managing (either referring or reviewing) DMO, framed as: "5 = most confident", "4", "3", "2", "1 = least confident"
Potential clinical tools, including classification systems or guidelines utilised by practitioners	5 – 7 20 – 21	(a) Free text response to specify clinical tool/s used in decision-making when assessing a patient with DR (b) Reference to any classification systems, charts or guidelines in routine everyday practice to detect, classify or manage DR (c) Free text response to suggest improvements to currently available guidelines for DR management
Case scenarios †	8	Forced choice selection of management decision (either 'review' or 'refer to ophthalmology')
Enquiry of DR-associated risk factors †	9	Self-reported frequency of enquiring about the following risk factors, framed in the order of: "never", "rarely", "sometimes", "almost always", "always"
Type of retinal imaging available at respondents' place of practice	10	Unrestricted selection of four common retinal imaging in primary care practice (retinal camera, OCT, OCT-A and wide-field imaging)
Opinions and attitudes towards OCT in the context of DMO		(a) Rated the usefulness of OCT and self-reported confidence at using OCT to diagnose DMO according to a 5-point Likert scale‡
➤ with OCT in practice‡	11 – 14	(b) Selection of "yes/no/unsure" options on the utility of an OCT grading in DMO‡
➤ without OCT in practice§	16 – 18	(c) Selection of "yes/no/other (please elaborate:)" response on whether OCT has changed the way they managed DMO‡

		(d) Free-text response on how DMO is managed§ (e) Self-reported confidence at diagnosing DMO§ (f) Selection of “yes/no” response on whether the absence of OCT affects their management of DMO§
Opinions about OCT-A		(a) Rated the usefulness of OCT-A in the diagnosis of DR and / or DMO† (b) Selection “yes/no/unsure” response and the option of free-text response on whether OCT-A would be a useful screening tool for DR and / or DMO§
➤ with OCT-A in practice†	15, 19	
➤ without OCT in practice§		
Practitioner demographics	22 – 27	Age Sex Years in optometry practice Average hours consulting in clinical optometric practice University at which optometry training was completed Principal type of work

Table 1. Summary of survey categories and questions. DR: diabetic retinopathy; DMO: diabetic macular oedema; OCT: optical coherence tomography; OCT-A: OCT angiography.

† These questions were further divided into several sub-questions

‡ and § Indicates conditional questions only displayed depending on respondents’ prior response for question 10 on the type of retinal imaging device available to them at their practice.

Data analysis:

All surveys where mandatory responses were completed were included. Statistical analysis was performed using IBM SPSS® statistics software version 21.0 (www.ibm.com/analytics/spss-statistics-software). Descriptive statistics were used to evaluate demographic information, management patterns in case scenario questions, frequency of enquiry of routine risk factors related to diabetes and the types of retinal imaging equipment available. Chi-square test or Fisher’s exact

test was used to compare data consisting of proportions of respondents. Spearman correlation tests were used to assess associations between ordinal variables. For subsequent analysis, self-reported confidence levels for grading and managing DR were grouped into a new variable which represented the sum of the self-rated confidence scores for assessing DR; likewise, for self-reported confidence for detecting and managing DMO. As an example, if a respondent rated '3' for their confidence in grading DR and '3' for their confidence in managing DR, the resultant score was 6. Higher confidence scores ranged from 6 to 10.

Cases 3, 4, 5, 9 and 10, where respondents were divided in their views of appropriate management, were chosen as a proxy for optometrists' management decisions in DR and DMO. Binary logistic regression analyses were employed to explore potential predictive factors to decisions to review or to refer to ophthalmology for the respective cases; covariates were the routine use of clinical guidelines, confidence levels, age, years of clinical practice and availability of an OCT device at their practice for cases 9 and 10. For all analyses, a p-value of less than 0.05 was considered statistically significant.

Thematic analysis was performed on free text responses in reference to the phases of thematic analysis described by Nowell *et al*.³⁴ and Braun and Clarke.³⁵ Briefly, initial codes were derived inductively from the data. Main themes and subthemes were then formed by deductively categorising these initial codes. These themes were reviewed to ensure they reflected the respondents' voices and maintained relevance to the question of interest.

Results:

Altogether, there were 205 unique survey respondents (optometrists) who consented to participate. Incomplete data from 38 individuals were excluded, leaving a total of 167 surveys for analysis. One hundred sixty-five of these were online responses and two were hard copy. The survey completion rate was 0.81 (167/205). Our sample represents approximately 3% of the total number of optometrists in Australia.

Characteristics	Number of responses (%)	
Age (years)		
20 – 29	71	(42.5)
30 – 39	45	(26.9)
40 – 49	22	(13.2)
50 – 59	20	(12.0)

60 – 69	7	(4.2)
≥ 70	2	(1.2)
Sex (n = 167)		
Male	57	(34.1)
Female	110	(65.9)
Other	0	
Years in optometric practice (n = 167)		
≤ 10	95	(56.9)
11 – 20	30	(18.0)
21 – 30	27	(16.2)
31 – 40	12	(7.2)
> 40	3	(1.8)
Principal type of optometric practice (n = 167)		
Academic	9	(5.4)
Corporate practice	55	(32.9)
Hospital clinic	3	(1.8)
Public health clinic	28	(17.4)
Private (independent) practice	65	(38.9)
Refractive surgery clinic	1	(0.6)
Others	6	(3.0)

Table 2. Summary of participant demographics

Table 2 provides a summary of respondents' demographics. The majority were female (n = 110, 65.9%). The average age of respondents was 36 years old (age range: 21 to 75 years old). The reported number of years in optometric clinical practice ranged from 1-46 years; however, nearly half of respondents had less than or equal to 10 years of clinical practice. Most (88%, n = 147) had completed their optometry training in Australia.

Optometrists' self-reported confidence levels in the assessment of diabetic retinopathy (DR) and diabetic macular oedema (DMO)

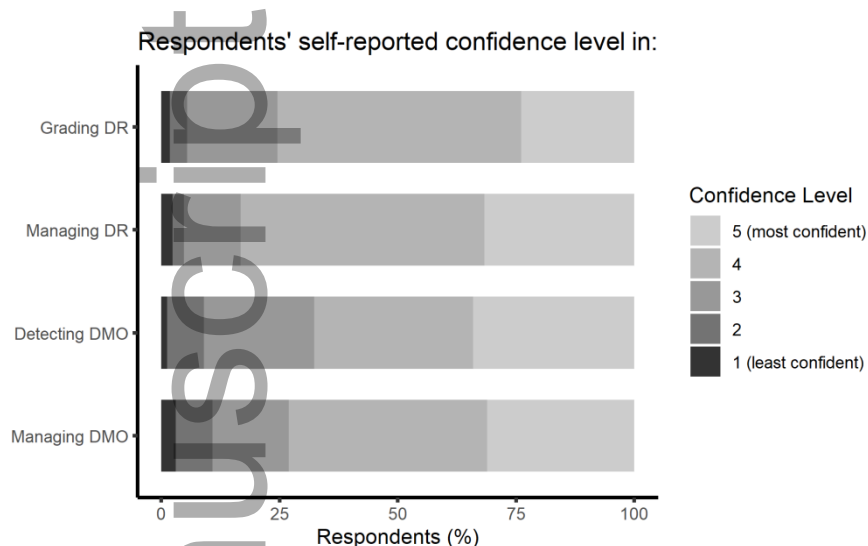


Figure 1. Respondents' self-reported confidence levels in grading diabetic retinopathy (DR), managing DR, detecting diabetic macular oedema (DMO) and managing DMO.

Figure 1 shows the self-reported confidence of respondents in grading DR, managing DR, detecting DMO and managing DMO. The majority indicated '4' and '5' on the five-point Likert scale, in grading DR severity ($n = 126$, 75%) and managing DR ($n = 139$, 83%). Likewise, most were confident in detecting DMO and managing DMO. The self-reported confidence level in grading and managing DR were significantly correlated ($r_s = 0.55$, $p < 0.001$) and self-reported confidence levels in detecting DMO correlated with confidence levels in managing DMO ($r_s = 0.57$, $p < 0.001$).

Optometrists' self-reported assessment of diabetic retinopathy (DR) and diabetic macular oedema (DMO) – referral patterns and frequency of routine enquiry of diabetic-related risk factors.

For each case scenario, respondents were asked to base their management decisions (either 'review' or 'refer to ophthalmology') on clinical presentation. Table 3 presents each case description arranged according to increasing severity of DR. Figure 2 summarises self-reported frequency of routine enquiry of risk factors by optometrists.

Case	Case descriptions	Percentage of optometrists (%)
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number		Review	Refer to ophthalmology
1	Your patient has no signs of diabetic retinopathy	99.4	0.6
2	Your patient has $\geq$ two microaneurysms at the peripheral retina	100.0	0
3	Your patient has $\geq$ two microaneurysms at the macula region	71.3	28.7
4	Your patient has scattered retinal haemorrhages and microaneurysms at the posterior pole and peripheral retina	73.1	26.9
5	Your patient has scattered microaneurysms, retinal haemorrhages and hard exudates at the posterior pole and peripheral retina	41.3	58.7
6	Your patient has extensive microaneurysms, retinal haemorrhages, hard exudates and occasional cotton wool spots at the posterior pole and peripheral retina	10.2	89.9
7	Your patient has definite venous beading in 2+ quadrants and prominent intraretinal microvascular abnormalities in 1+ quadrant AND no sign of proliferative retinopathy.	12.0	88.0
8	Your patient has new vessels at the disc and/or elsewhere	1.2	98.8
9	Your patient has retinal thickening and hard exudates at the posterior pole, but distant from the centre of the macula	62.3	37.7
10	Your patient has retinal thickening and hard exudates in proximity to the macula, but greater than 500 microns from the centre of the macula	29.9	70.1
11	Your patient has retinal thickening or hard exudates at or within 500 microns from the centre of the macula	1.8	98.2

Table 3. Summary of respondents' referral decision for each case scenario.

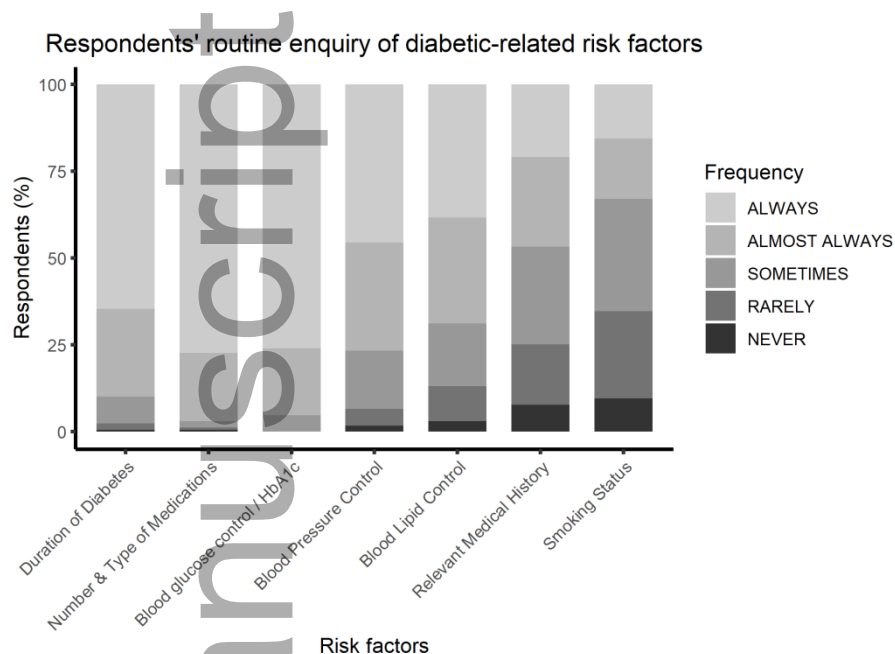


Figure 2. Summary of respondents' self-reported routine enquiry of risk factors.

Optometrists' use and perceptions of clinical guidelines:

Over half (66.5%, $n = 111$) of respondents indicated that they referred to classification systems and guidelines to aid detection, classification and management of DR. Years of clinical experience did not predict routine use of guidelines (OR: 0.91, 95% CI: 0.48 – 1.74; $p = 0.78$). A higher self-reported confidence level for assessment of DR was associated with the routine use of clinical guidelines ($p = 0.002$, two-tailed Fisher's exact test); however this association was not observed with a higher confidence level for assessment of DMO ($p = 0.47$, two-tailed Fisher's exact test).

Almost half of optometrists ($n = 80$, 48%) agreed that currently available clinical guidelines should be updated or improved whereas 41% were unsure. Fifty optometrists provided suggestions for how currently available guidelines could be updated, using the free text field provided. One main theme was the need for increased clarity of clinical guidelines to facilitate ease of use. A subtheme was that respondents suggested enhancing clarity particularly in the management of DMO. "Clearer

referral/review pathways” and “How much macular oedema requires referral, how much can we sit on and review,” were examples within this main theme. Another subtheme was improving usability with suggestions such as simplifying clinical grading systems or enhancing readability by incorporating flowcharts and / or pictures. The second main theme was the integration of retinal imaging technology, explicitly OCT, into future guidelines to support clinical decision-making. A subtheme was to improve the guidelines’ relevance to optometrists’ work setting by accounting for the availability of specialised equipment within the workplace or different practice settings such as a rural practice, to support optometrists’ clinical decision-making.

Proportion of optometrists with retinal imaging equipment, including optometrists’ perceptions and opinions to retinal imaging technology

Type of equipment	Proportion of respondents with equipment available	
	n = 167 (%)	
Retinal camera	153	(91.6)
OCT	126	(75.5)
OCT-angiography	31	(18.6)
Wide-field imaging (e.g., OPTOS, wide-field OCT imaging)	70	(41.9)
No available retinal imaging devices	2	(1.2)

Table 4. Availability of retinal imaging equipment in optometrists’ clinical practices. OCT: optical coherence tomography.

Nearly all respondents had some form of retinal imaging technology available at their practice, as summarised in *Table 4*; 92.1% (n = 116) of optometrists that had an OCT available provided the highest positive rating of “5” on the Likert scale when asked about their opinion on the usefulness of OCT in the detection of DMO. These same practitioners (n = 111, 88.1%) agreed that OCT changed the way they managed DMO and most (n = 121, 96.8 %) responded that they were confident in using OCT to diagnose DMO. More than half of the practitioners with OCT (n = 80, 64%) agreed that an OCT grading scale would aid their diagnosis of DMO.

Optometrists who did not have an OCT device at their practice were asked about the clinical tools they used to detect DMO; 87.5% of those without an OCT reported using dilated retinal examination. Sixty per cent also indicated retinal cameras as one of their clinical tools, with approximately a third

relying on their patients' visual acuity (35.0%) and / or an Amsler grid (37.5%) to guide their decision-making. When asked whether OCT-A would be a useful screening tool for DR and / or DMO, 43.1% indicated 'yes' whilst approximately half of optometrists (n = 76, 45.5%) indicated 'not sure'.

Association of optometrists' self-reported confidence levels with optical coherence tomography (OCT) availability

Figure 3 shows two groups of respondents, those with or without an OCT device, and their self-reported confidence levels in the assessment of DR and DMO, respectively. There was a significant association between having an OCT device available and higher self-reported confidence levels in the assessment of DMO ($\chi^2 = 20.90$, $p < 0.001$). There was no significant association between the availability of an OCT and confidence in assessing DR ($\chi^2 = 0.76$, $p = 0.38$).

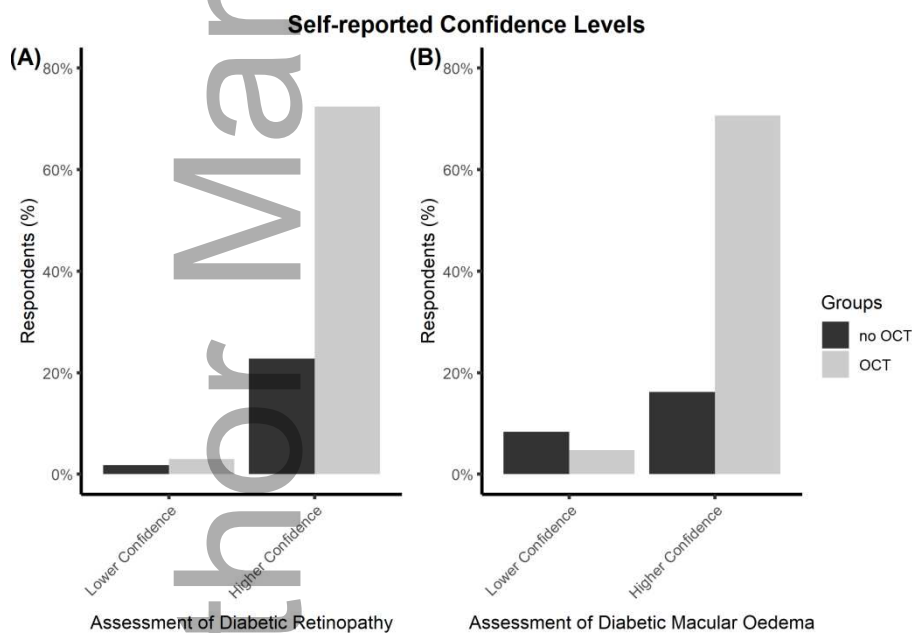


Figure 3. (A) Self-reported confidence levels of respondents having optical coherence tomography (OCT) available within the practice and respondents without OCT available in the assessment of diabetic retinopathy (DR); assessment of DR involved grading and managing DR. (B) Self-reported confidence levels of respondents having OCT available within the practice and respondents without

OCT available in the assessment of diabetic macular oedema (DMO); assessment of DMO included detecting and managing DMO.

Predictive factors for optometrists' referral patterns:

We were interested in factors that predicted optometrists' referral patterns, as observations in *Table 3* suggests that respondents were divided in their view of appropriate management, particularly in cases 3, 4, 5, 9 and 10. However, the only significant associations found by univariate logistic regression analyses were with self-reported confidence levels in DR for case 5 (OR: 0.74, 95% CI: 0.59 – 0.93; $p = 0.01$) and self-reported confidence levels in DMO for case 10 (OR: 1.36, 95% CI: 1.09 – 1.68, $p = 0.006$).

Discussion:

This study provides a cross-sectional picture of the clinical practice behaviours for the assessment and management of DR and DMO in a limited sample of Australian optometrists. Our data reveal that optometrists were indeed engaged with diabetic eye care.

A key difference between this investigation and previous studies^{22, 32} evaluating optometrists' DR management practices is relatively increased confidence in detecting DMO, which is associated with the availability of an OCT device within the optometric practice (*Figure 3*). An increased confidence in detecting clinical signs of DR has also been associated with retinal camera use in the past.²² However, our study was not designed to determine whether having an OCT device alters management decisions. We found no clear distinction between the referral patterns of those who did and did not report having an OCT available in their practice. The inherent bias of clinicians' self-evaluation and self-reporting is a potential confound; this study did not measure true referral patterns, clinical competence or performance of optometrists.

Optometrists routinely enquired on duration of diabetes, number and types of medications and blood glucose control (*Figure 2*). The frequency of enquiry for blood pressure and cholesterol control was comparable to previous literature.²² However, a concern raised by this study is optometrists' poorer frequency of enquiry for relevant medical history (for example, having a history of peripheral neuropathy and chronic renal failure). Manifest diabetic retinopathy is closely linked to peripheral neuropathy³⁶⁻³⁸ and nephropathy,^{39, 40} as well as positively associated with mortality and cardiovascular events.⁴¹ In light of optometrists' primary care role and contribution to an individual's

overall healthcare,⁴² reservations in questioning for relevant medical history suggests a potential gap in optometrists' knowledge of systemic disease.

This study also highlights limited utilisation of standardised grading scales in DR management. As such, it is unsurprising that the routine use of classification systems, charts or guidelines by optometrists was not a predictive factor in their referral decisions. The non-association between use of clinical guidelines and optometrists' self-assessed confidence in detecting and managing DMO in this study is contrary to Ting *et al.*,²² who reported that reading Clinical Practice Guidelines for DR was associated with an increased confidence in detecting DMO. This discrepancy may suggest a diminishing clinical relevance of available guidelines for DMO detection and management. Recommendations from current Australian clinical guidelines^{20, 43} endorse the use of dilated ophthalmoscopy or fundus photography for the identification of surrogate markers of retinal thickening (i.e., exudates, microaneurysms and / or haemorrhages). However, increased accessibility of OCT in primary eye care as reported here and in general ophthalmic practice²³ indicates a shift away from conventional means of detecting DMO. A recent Cochrane review⁴⁴ further acknowledged OCT as the new reference standard owing to its increased accessibility in modern practice along with its ability to inform on retinal layer structures.

Given that early identification of DR and DMO is key to preventing vision loss, the uptake of retinal imaging technology by primary care optometrists in Australia and internationally²¹ is likely to be beneficial. Indeed, the merits of OCT technology in the detection of DMO are widely recognised by international guidelines⁴⁵ and as an accepted end-point of clinical trials.^{27, 46} A number of groups also support integration of novel retinal imaging technologies to improve existing screening programmes.^{47, 48} New Zealand's Wellington DR screening programme provides a working model of how existing primary care infrastructure (trained optometrists along with existing ophthalmic facilities – OCT-technology and ultra-wide field imaging) can facilitate timely DR screening, management and continuity of care.¹⁸ Optometrists in the Wellington region are contracted to provide primary care assessment within the community with the oversight of hospital ophthalmology.^{18, 49} Establishing shared care models between ophthalmology and optometry contribute to reduced waiting times for patients,¹⁷ and community-based care can improve opportunistic detection of non-diabetic related pathologies as well as broaden accessibility of eye care services to groups at a higher risk for diabetes.¹⁸ Hence, individuals at a lower risk of losing vision from diabetes may be comfortably managed in the community, thereby channelling healthcare resources to those who require it most.

In countries where systematic screening programmes are employed, such as in the UK, the use of OCT in community-based DR screening sites are considered to improve their screening programme's cost-effectiveness and specificity to detect DMO.⁵⁰ A UK audit found that only 21% of individuals referred for maculopathy on the basis of retinal photography satisfied the criteria for clinically significant macular oedema (CSMO) and thus required ophthalmic intervention.⁵¹ A potential consideration when considering the utility of OCT in community screening is the potential for poor image quality in some OCT devices. One Australian study found no advantage to the addition of an OCT camera system to a rurally-based DR screening programme relative to conventional retinal photography.⁵² Additional training of staff involved in image acquisition, and further developments to OCT technology, may assist in reducing the number of poor quality images obtained.

The generalisability of this study is impaired by self-selection bias and by under-representation of middle-aged to older practitioners. Respondents are likely to consist of motivated practitioners who frequent social media platforms. Clinicians' self-reporting may overestimate the quality of clinical care.⁵³ Study methodologies, such as standardised patient studies,⁵⁴ clinical audits⁵⁵ or triangulation⁵⁶ may be more suited to appraise and provide results on the quality of clinical practice and / or the competency of practitioners in eye care service delivery.⁵⁷ We did not collect specific information regarding respondents' geographical location, which may have better informed the interpretation of our results if there are distinct regional differences in practice patterns depending on overall eye care workforce distribution.

This study provides a useful insight into current optometric practices in the assessment of DR and DMO and identifies key areas where there may be scope for improvement. An example here is the small minority of optometrists who opted to review patients with clinical presentations (based on the Proposed International Clinical Diabetic Retinopathy and Diabetic Macular Edema Disease Severity Scale⁵⁸) of severe non-proliferative DR (case 7, *Table 3*), moderate DMO (case 10) and severe DMO (case 11). It is important to interpret these findings apropos of the context of the survey where optometrists provided binary (review / refer to ophthalmology) responses to clinical vignettes that had limited information. Understandably, clinical decision-making is nuanced, and optometrists' management decisions can depend on various compounding factors that were not explicitly enquired about within the survey, some of which are visual acuity, medical history and logistical considerations associated with practice location. Nevertheless, particularly for cases 8 and 11, there is little ambiguity in the need for referral from the primary care setting. In each of these cases, 2-3 optometrists of the 167 chose to review. We explored these cases and note that two of the five optometrists who responded in this way received their training outside Australia. For the

total sample, 88% earned their entry-to-practice qualification in Australia. The age of these optometrists was broad, ranging from 27 to 60 years. If these responses genuinely reflect management choices in the light of full clinical information, such management would be inappropriate.

The provision of quality, evidence-based CPD activities can aid in keeping clinicians' knowledge up-to-date, while improving clinical outcomes by translating new research into clinical practice.⁵⁹ This study has identified that more attention on the decision-making criteria for referral is required as a minority of optometrists may benefit from clear, consolidated findings from recent DR and DMO-specific clinical trials to inform their DR and DMO management. Further CPD activities may also usefully focus on topics such as ocular manifestations of systematic diseases and how to maximise the use of retinal imaging devices in clinical practices, given the increasing availability of OCT and OCT-A. This study also highlights the uptake of specialised equipment in primary care practices as a potential resource for nationwide diabetic eye screenings. Supporting primary eye care entails investments in a clinically trained, motivated workforce and capitalises on practices' existing infrastructure. In light of the public health burden of diabetes and incremental rise in healthcare costs, strengthening community-based primary eye care may be a feasible long-term solution to tackle DR-related visual impairment.

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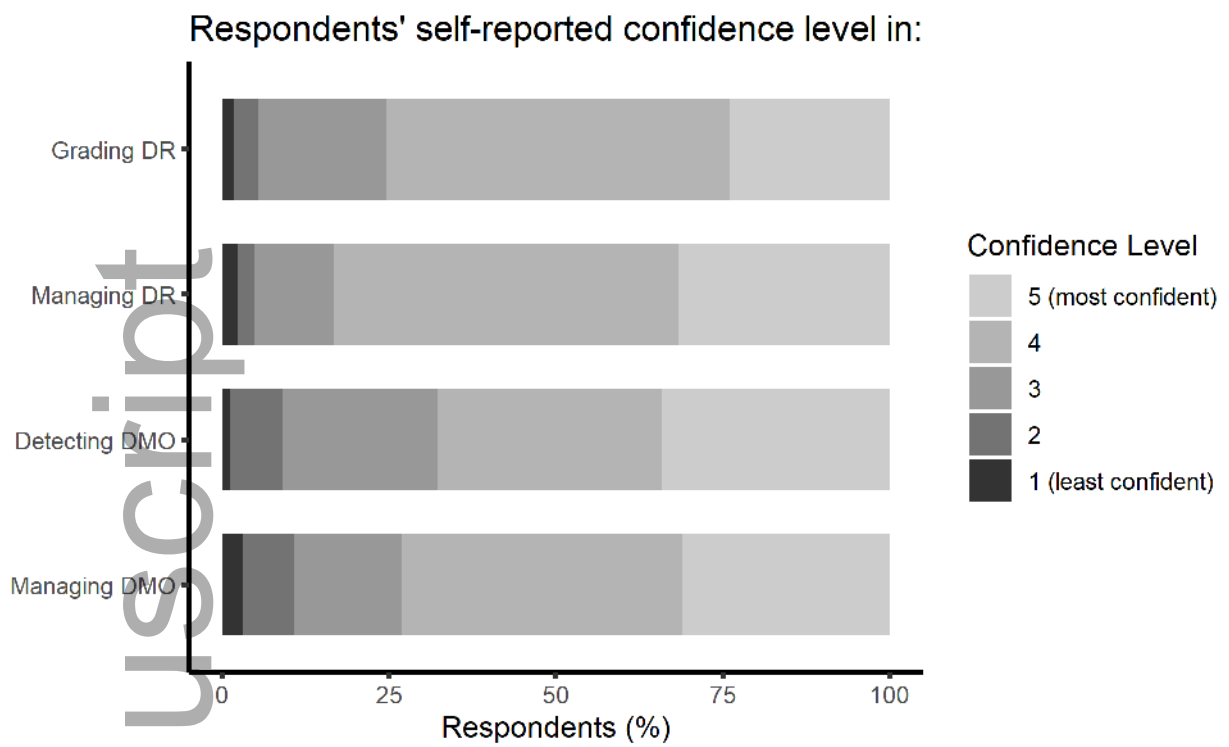
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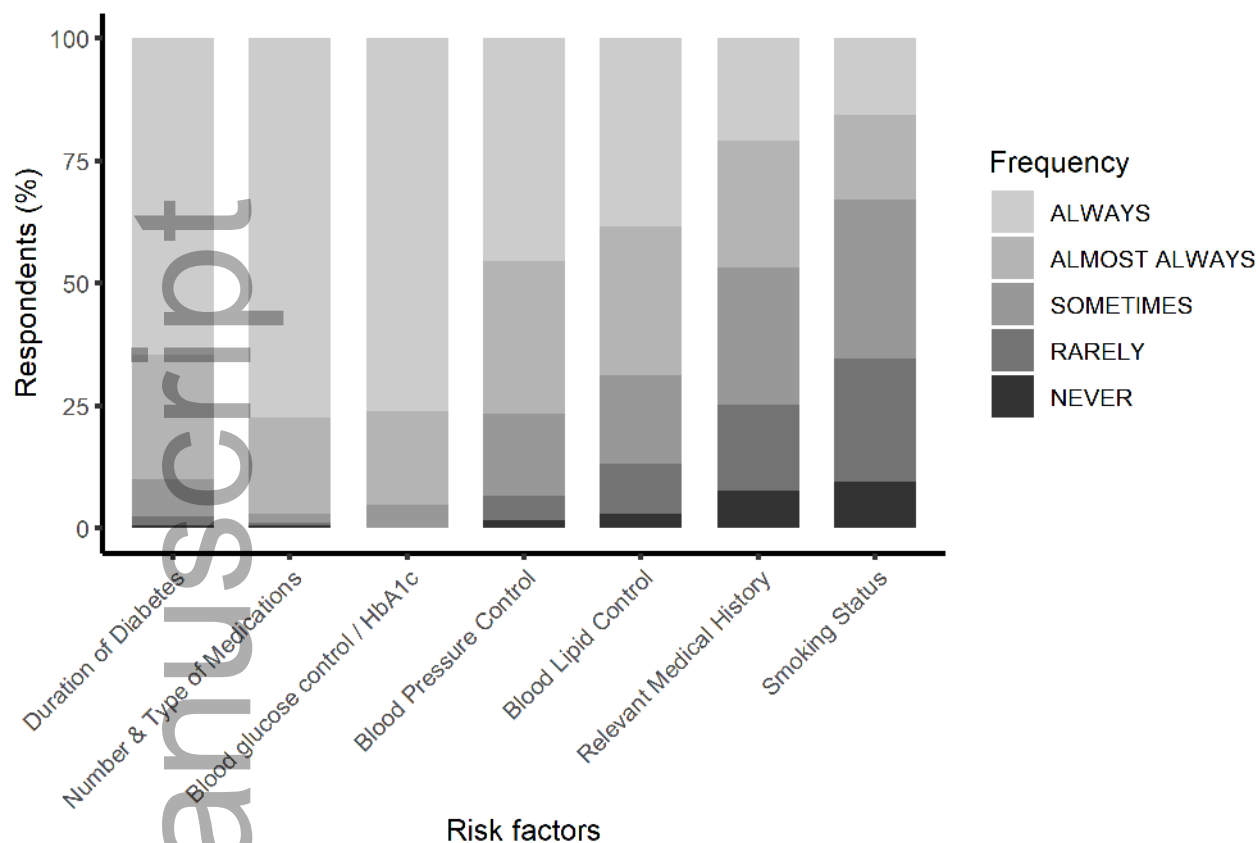
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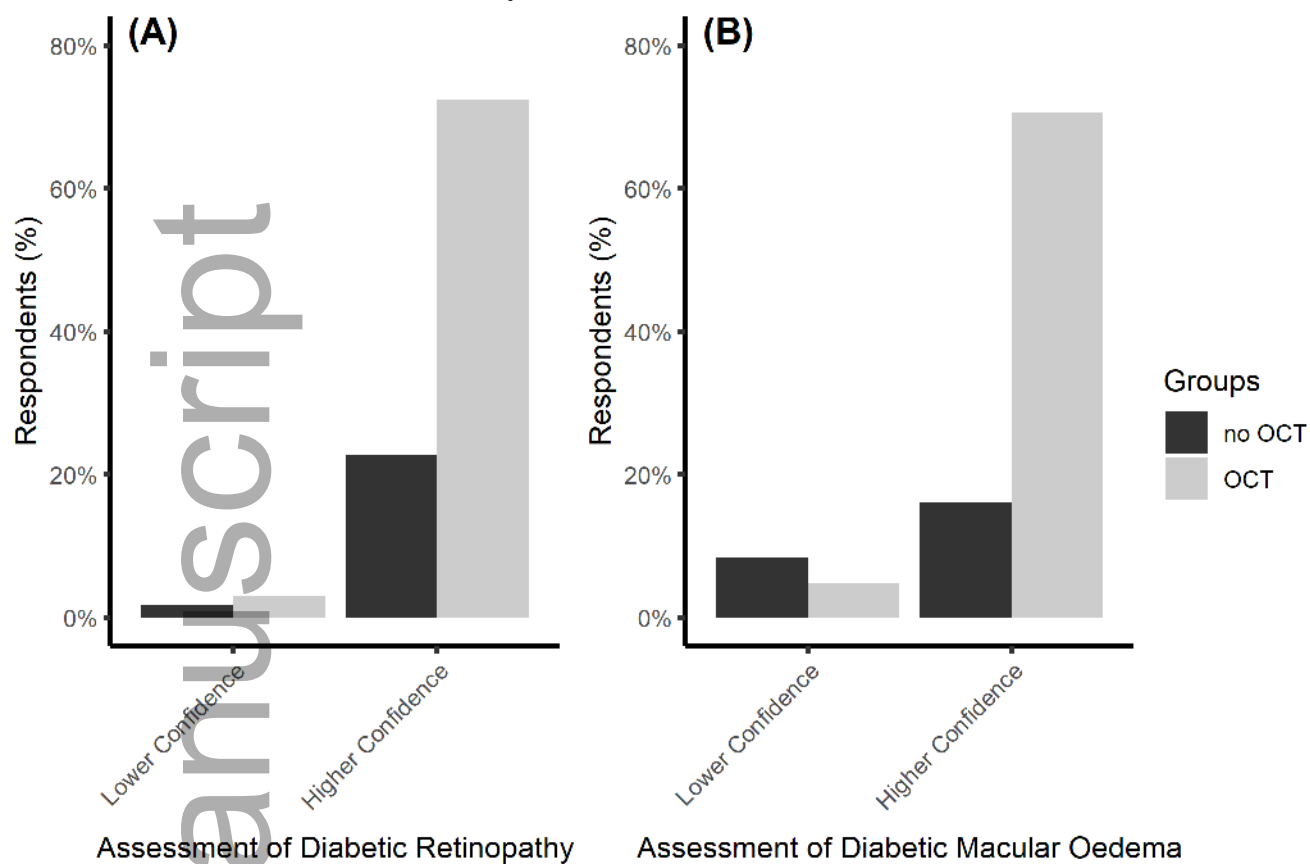
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Respondents' routine enquiry of diabetic-related risk factors



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Self-reported Confidence Levels



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