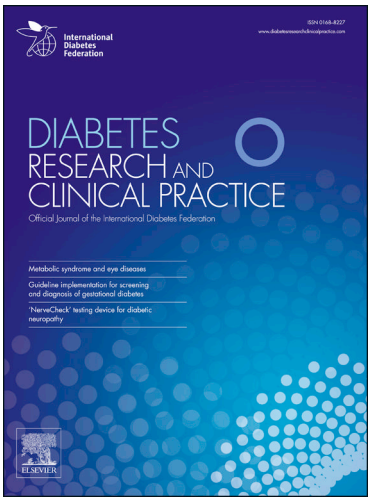

Global perspectives on the provision of diabetic retinopathy screening and treatment: Survey of health care professionals in 41 countries

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Global perspectives on the provision of diabetic retinopathy screening and treatment: Survey of health care professionals in 41 countries

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Structured Abstract

Aim

To assess the level of awareness and provision of screening and treatment for Diabetic Eye Disease (DED) comprising Diabetic Retinopathy (DR) and Diabetic Macular Edema (DME) among health care professionals.

Methods

The study was conducted in two phases. The first phase consisted of a qualitative study, based on semi-structured face-to-face and telephone interviews in 8 countries. The second phase used a quantitative approach utilising online surveys in 41 countries. The survey for health care professionals comprised of 43 questions covering provider information, practice characteristics, management of adults with diabetes and specific information from ophthalmologists on screening and treatments for DR.

Results

There were 2,329 health care professionals who participated in the online survey. More than one third of diabetes specialists surveyed reported that they did not discuss eye care with their diabetes patients. Nearly two-thirds of all health care professionals surveyed reported that they had written information about diabetes for patients available in their practice. Only one in five (22%, n=58) primary care providers reported they had material that contained sufficient information on eye complications, and 37% (n=252) of ophthalmologists reported that they had sufficient information on eye complications.

Sixty-five percent (n=378) of ophthalmologists reported that most of their patients presented when visual problems had already occurred. Six percent (n=36) stated that most of their patients presented when it was already too late for effective treatment.

The most substantial barriers to eye health mentioned by health care professionals responding to the survey were: a patients' lack of knowledge and/or awareness about eye complications (43%), followed by lack of importance given to eye examinations by patients (33%), and the high cost of care (32%). Ophthalmologists also reported late screening (66%), and lack of patient education materials (55%) as obstacles for improving eye health outcomes.

Conclusion

Health care professionals need to be appropriately supported and trained so they can provide adults with diabetes with information about the risks of DR, support them in reducing their risk, and advocate for the provision of affordable DR screening and treatment as required.

1. Introduction

An estimated 425 million people (aged 20-79 years) are currently living with diabetes globally, of whom half (50%) remain undiagnosed[1]. Consequently, when diagnosed, many people with diabetes have already developed complications arising from their condition. One of the most common complications of diabetes is diabetic eye disease (DED)[2] comprising of several conditions including diabetic macular edema (DME), diabetic retinopathy (DR), cataract and glaucoma. If not treated early and correctly, DED can progress to cause visual impairment and blindness[3][4].

Diabetic retinopathy occurs when blood vessels in the light-sensitive region of the eye, the retina, leak or become blocked, due to prolonged high blood glucose levels[3]. DR is the most common cause of vision loss in people with diabetes [5][6] and globally is the leading cause of visual impairment and blindness among working age population[7][8]. A common complication of DR is DME, where leakage from retinal blood vessels builds up in the central region of the retina, the macula, causing it to swell[5]. DME can be associated with any severity of DR, and as the macula is responsible for detailed central vision, it can lead to rapid vision loss if not detected and treated promptly. However, DR can be prevented or delayed by timely diagnosis and management of diabetes, and blindness can be prevented or delayed in people with DR by regular eye screening and appropriate treatment[9].

Despite the high risk of people with diabetes developing DED, many suffer from limited access to appropriate screening and treatment. In some countries, this is partly due to a lack of appropriately-trained health care professionals. To address this, the International Federation on Ageing (IFA), in collaboration with the International Diabetes Federation (IDF), and the International Agency for the Prevention of Blindness (IAPB) conducted a multi-country research study, called the DR Barometer. This research project examined risk awareness, access to DR screening and treatment, the nature of health services and community support available, and the socioeconomic consequences of DR and DME.

In this paper, the detailed findings on the provision of DR screening and treatment from the perspective of health care professionals are presented.

2. Methods

The DR Barometer Study constituted of two phases. Phase 1 utilised qualitative methods, and phase 2 employed quantitative methods. In both phases, adults with diabetes (patients) and health care professionals (providers) were invited to join the study and analysed through separate surveys.

In phase 1, the surveys for adults with diabetes and health care professionals were developed following the completion of semi-structured interviews in eight countries: Argentina, Bangladesh, Germany, Japan, Mexico, Romania, Saudi Arabia and Uganda. The countries were purposively selected to reflect World Bank Income Groups [10] and regions as defined by the World Health Organization (WHO) [11].

Details of the interview structure, delivery and analysis have been described previously [12]. The data from the interviews were used to inform the development of the surveys in the quantitative study (Phase II). Data from the survey for adults with diabetes have been published separately [13].

The survey for health care professionals comprised 43 questions covering provider information, practice characteristics, management of adults with diabetes and specific information from ophthalmologists on screening and treatments for DR. The full questionnaire is available online [12].

Similar to the interviews, the survey was aimed to be implemented in a globally diverse set of 41 countries, covering all WHO regions [11] and World Bank Income Groups [10] (see table 1). Surveys were developed in English and then translated into the respective language of each country, before being back-translated to ensure veracity of the translations. National member organisations of the partners (IFA, IAPB and IDF), professionals from hospitals, diabetes centres, and clinicians in each of the countries selected were then invited to disseminate the surveys amongst adults with diabetes, older people and health care professionals. The study populations were therefore self-selected samples of adults with diabetes and health care professionals, who accessed the survey predominantly from professional or patient and seniors organisations concerned with diabetes or eye health, as well as from membership organisations of older adults. All responses were anonymous, and the survey was open and available for completion for a period of 9 months in 2015.

Evaluation and analysis of survey data has been previously described [13]. Briefly, data were cleaned with removal of implausible data values and of duplicate records. Continuous data were summarised using mean, standard deviation, minimum, median and maximum and categorical data were summarised using frequency counts and percentages. All analyses were performed using SAS version 9.4 [14].

For presentation of data on DED, the following definitions were used: no DED was defined as 'without diabetic eye disease'; DED was defined as 'with diabetic eye disease' AND 'without diabetic macular edema (DME); and DME was defined as 'diabetic eye disease' AND 'diabetic macular edema'.

3. Results

Interviewee characteristics

In total, 48 healthcare providers were interviewed and each region was equally represented. (Table 1) Both Northern and Southern part of Americas as well as Eastern and Western part of Europe had six interviews. Twenty-nine percent of respondents were primary care providers, 13% diabetes educators, 17% endocrinologists or diabetes specialists, 19% ophthalmologists, and 19% retinal specialists. The majority (79%) worked in urban settings.

Survey respondent characteristics

There were 2,329 health care professionals (providers) who responded to the survey. (Table 1) Based on WHO's regions, 45% (n=1048) were from the European Region, 23% (n=536) from the

Region of the Americas and 16% (n=382) from the Western Pacific Region, with the remaining 16% (n=363) from the three other regions (African Region, South-East Asia Region, Eastern Mediterranean Region). Based on World Bank income classification, fifty-two percent of respondents (n=1216) were from high-income countries and 45% (n=1043) were from upper-middle-income countries.

Regarding their professional expertise, thirty-seven percent of respondents (n=855) were ophthalmologists, 17% (n=403) were medical doctors specialising in diabetes, and 16% (n=365) were primary care providers. The rest were optometrists, nurses, health educators or other types of health care professionals. The ophthalmologists included general ophthalmologists and retinal specialists. There was a similar proportion of ophthalmologists in high-income countries (36%, n=441) and upper-middle-income countries (38%, n=397).

The majority of health care professionals (89%, n=1924) had their main practices in urban settings. Forty-seven percent (n=1019) practiced in the governmental sector whilst almost a third (29%, n=633) had their main practice in the private sector, 15% (n=331) worked in a combined or mixed sector and 8% (n=172) in the non-profit sector.

Ophthalmologists had their main practice setting in hospitals (49%, n=396) or eye clinics (46%, n=376) whereas diabetes specialists practiced primarily in diabetes clinics (45%, n=175) or hospitals (37%, n=144). The majority of primary care providers were in general medical practice (72%, n=239) and a further 13% (n=44) in hospitals.

Table 1. Characteristics of participants in both phases of the study

Characteristic	Interviews	Questionnaires
All	48	2,329
Region		
Europe	25% (n=12)	50% (n=2163)
Americas	25% (n=12)	23% (n=536)
Western Pacific	13% (n=6)	16% (n=382)
Eastern Mediterranean	13% (n=6)	11% (n=246
Africa	13% (n=6)	4% (n=85)
South East Asia	13% (n=6)	1% (n=32)
Gender		
Female	46% (n=22)	-
Male	54% (n=26)	-
Age		
18-39	15% (n=7)	-
40-59	71% (n=34)	-
60-74	15% (n=7)	-
75+	0% (n=0)	-
Residence		
Rural	21% (n=10)	11% (n=405)
Urban	79% (n=38)	89% (n=1924)
Specialty		
Primary care provider	29% (n=14)	16% (n=365)
Endocrinologist	17% (n=8)	17% (n=403)

Eye Care Professional Other (including nurse or diabetes educator)	38% (n=18) 13% (n=6)	37% (n=855) 30% (n=706)

Providing information to adults with diabetes

During routine visits, the topics most commonly discussed with adults with diabetes were: diabetes management and monitoring, eye care and exams, medicines and nutrition. Only 47% (n=127) of primary care providers and 62% (n=189) of diabetes specialists discussed eye care and examinations with their patients. In contrast, 94% (n=634) of ophthalmologists routinely discussed the topic yet many fewer discussed other issues such as diabetes management or blood pressure (Table 2).

Table 2. Heath care topics discussed with patients during a routine visit

Topic	All Providers n (%) (n=2,329)	Primary care n (%) (n=365)	Diabetes specialist n (%) (n=403)	Ophthalmologist n (%) (n=855)
Diabetes management and monitoring	1,326 (77.7%)	253 (94.4%)	284 (93.7%)	410 (60.5%)
Diet/nutrition	1,083 (63.4%)	237 (88.4%)	278 (91.7%)	241 (35.5%)
Exercise/physical activity	1,042 (61.0%)	232 (86.6%)	266 (87.8%)	222 (32.7%)
Medicines	1,210 (70.9%)	254 (94.8%)	288 (95.0%)	310 (45.7%)
Foot care and inspection	701 (41.1%)	175 (65.3%)	239 (78.9%)	50 (7.4%)
Blood pressure	1,071 (62.7%)	244 (91.0%)	280 (92.4%)	244 (36.0%)
Eye care and exams	1,249 (73.2%)	127 (47.4%)	189 (62.4%)	634 (93.5%)
Lipid check	835 (48.9%)	214 (79.9%)	253 (83.5%)	151 (22.3%)
Other	13 (0.8%)	1 (0.4%)	7 (2.3%)	1 (0.1%)
None of the above	31 (1.8%)	4 (1.5%)	2 (0.7%)	13 (1.9%)
Total valid response	1,707 (100.0%)	268 (100.0%)	303 (100.0%)	678 (100.0%)
Total missing	622	97	100	177

NB [1]: There were some missing data (not all respondents provided responses to every question). Percentages for the first row and column are calculated using the total number of respondents minus the number of missing values as the denominator. All other percentages are calculated using the total on the corresponding row of the first column as the denominator.
NB [2]: The group with DED excludes all adults with DME

Whereas nearly two-thirds (64%, n=1,089) of all providers had written information available about diabetes for patients in their main practice, only a third (34%, n=573) reported that the information on eye complications was sufficient. The nature of information available at these practices varied with the type of the provider. Only one in five (22%, n=58) primary care providers had material that contained sufficient information on eye complications, and 37% (n=252) of ophthalmologists had sufficient information on eye complications. Furthermore, 15% (n=102) of ophthalmologists had insufficient information on eye complications and 38% (n=258) did not have any written information available.

Screening for DR

Most health care professionals surveyed (73%, n=1,272) screened patients for DR. Screening occurred mainly in the clinic (79%, n=953) but also via outreach clinics and mobile vans (15%, n=177). These examinations were most frequently performed by ophthalmologists, who used a range of procedures including fundoscopy (99%, n=697), optical coherence tomography (89%, n=608), and angiography (86%, n=567).

Eye examinations were also performed by primary care providers and diabetes specialists, with fundoscopy performed by 42% (n=109) of primary health providers and 58% (n=181) of diabetes specialists. Angiography was performed by 15% (n=37) of primary care providers and 27% (n=81) of diabetes specialists.

For adults with type 1 diabetes, the majority of providers (51%, n=827) said that they would perform an initial eye exam as soon as the patient was diagnosed, while 21% (n=345) did so after a pre-determined number of years, and 14% (n=222) of providers said the timing varied on a case by case basis.

This approach was generally consistent amongst the different types of providers. For people with type 2 diabetes, 77% (n=1274) of providers said that they would perform an initial eye exam as soon as the patient was diagnosed, this percentage was even higher among diabetes specialists (87%, n=257). Eleven percent (n=177) of all providers reported that the timing varied on a case by case basis.

Seventy-six percent of providers (n=1,261) reported that their protocol for follow-up eye examinations for adults with diabetes was once per year. However, the timing varied amongst all providers with 69% (n=178) of primary care providers having yearly follow-up exams compared with 86% (n=254) of diabetes specialists.

Written protocols for the detection and management of diabetes-related vision issues were available in 53% (n=900) of the main practices of all providers but in 9% (n=157) of these practices, the protocols were not used by staff. Forty percent (n=107) of primary care providers reported that there were no written protocols available and a further 13% (n=34) had protocols but these were not used by staff. Thirty-nine percent of diabetes specialists and 49% (n=328) of ophthalmologists had protocols that were used by staff (see Table 3).

Table 3. Written protocols for the management of diabetes-related vision issues.

Response	All Health care professionals n (%) (n=2,329)	Primary Care n (%) (n=365)	Diabetes Specialist n (%) (n=403)	Ophthalmologist n (%) (n=855)
Yes, available and used by staff	743 (44%)	94 (35.6%)	115 (38.6%)	328 (48.8%)
Yes, available but not used by staff	157 (9.3%)	34 (12.9%)	34 (11.4%)	66 (9.8%)
Not available	596 (35.3%)	107 (40.5%)	131 (44.0%)	222 (33.0%)
Don't know/Not sure	191 (11.3%)	29 (11.0%)	18 (6.0%)	56 (8.3%)
Total valid response	1,687 (100.0%)	264 (100.0%)	298 (100.0%)	672 (100.0%)
Total missing	642	101	105	183

NB [1]: The values [n=xx] show the maximum number of respondents in that group, but percentages are calculated from non-missing values for that group for the specific question

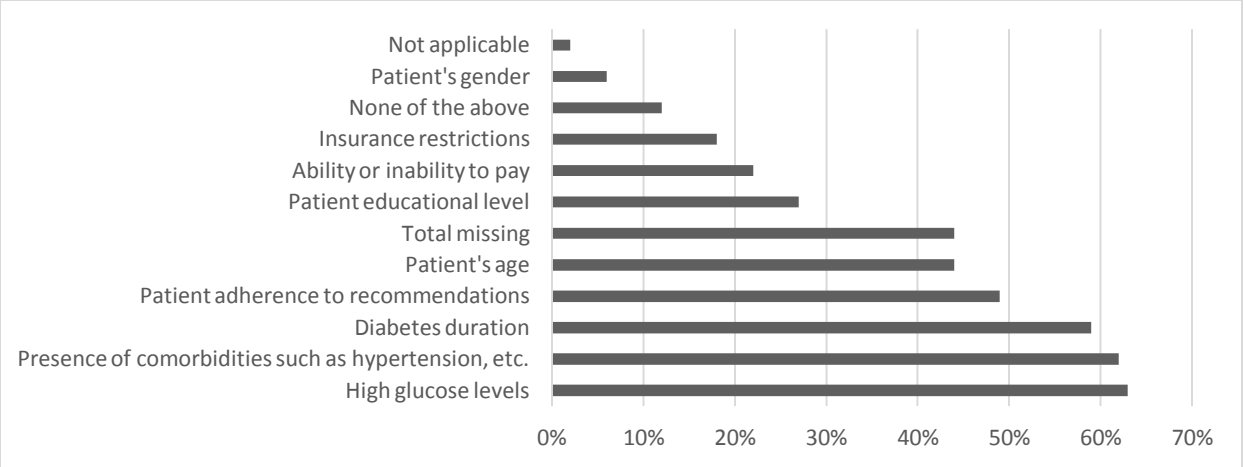
Treatment

Multiple treatments were available in the practices of ophthalmologists. Laser photocoagulation was offered in 80% (n=495) of practices, anti-VEGF therapies in 77% (n=476) of practices, intravitreal steroid in 74% (n=450), uncomplicated vitrectomy in 64% (n=389) and complex vitreo-retinal surgery in 61% (n=373). Most ophthalmologists (84%, n=507)) personally administered treatment for DR.

The lack of access to treatments in low- and middle- income countries was highlighted in the in-depth interviews during the first phase of the study. For example, a diabetes educator in Argentina reported that only two of the 20 ophthalmologists in Buenos Aires were able to treat DR. Apart from the lack of trained personnel, the high cost of medications and equipment limited access to treatments. An ophthalmologist in Uganda reported that there was insufficient equipment to provide laser treatment to those that need it.

More than half of ophthalmologists reported that diabetes duration, high glucose levels and the presence of co-morbidities influenced the treatment decisions of adults diagnosed with DR and DME. The age of the patient and adherence to recommendations were factors that influenced the nature of treatments and care management (Figure 1).

Figure 1. Patient characteristics that influence treatment decisions



NB [1]: The values [n=xx] show the maximum number of respondents in that group, but percentages are calculated from non-missing values for that group for the specific question

Training

The level of relevant experience and training on DED, including DME, among health care professionals varied. On average, providers had been practicing for 16 years and most had completed graduate or advanced degree education (72%, n=1,154). Twenty-one percent (n=122) of ophthalmologists had received no specific training on the diagnosis or treatment of DR and / or clinically significant DME. Of the 79% who had received training, half had done so within the past year (55%, n=256), while 18% (n=84) received training more than five years ago. Three quarters of ophthalmologists (77%, n=455) expressed interest in further education and certification on the management of DR.

The qualitative study highlighted the impact that a lack of knowledge amongst providers could have on the care of adults with diabetes. Findings suggest that while health care professionals knew of the risk of DR in people with diabetes, they did not always recognise the importance of retinal examinationsl.

> *First of all, they do not know how to send patients, or they do not recommend that the patient goes to a specialist. Unfortunately, the diabetologists and sometimes even our ophthalmology colleagues are happy just to prescribe glasses, without examining the optic fundus.* (Ophthalmologist, Romania)

Barriers to optimal eye health

From the provider perspective, the major barrier to optimising eye health faced by adults with diabetes was a lack of knowledge and / or awareness about the potential effect of diabetes on their eyes. Overall, 43% (n=732) of providers reported this as a barrier, including 51% (n=347) of ophthalmologists. Furthermore, 65% (n=378) of ophthalmologists reported that most of their patients presented when visual problems had already occurred. Six percent (n=36) stated that most of their patients presented when it was already too late for effective treatment. Only 29% (n=169) said that most patients presented in time for screening.

In interviews conducted in the qualitative study, primary care providers and diabetes specialists felt that many of their patients with diabetes did not appreciate the importance of eye screening and were not motivated to visit an eye doctor if they did not have symptoms of vision impairment. They reported that their patients did not understand that a person may have asymptomatic DR and that early treatment reduces the risk of vision loss.

> *Those who were referred, they do not come until they are not able to see. Otherwise, they say that I was told five years ago, but I could see, so I did not come. They wait for vision problems, then come. For DR that is too late.* (Ophthalmologist, Uganda)

Other barriers to optimising eye health included: adults with diabetes feeling that eye examinations were not important; the high cost of care; long wait times for an appointment; patients feeling eye complications were unlikely to happen; patients' fear of treatment or its results; limited access to eye specialists; and the complex referral process (Table 4).

The qualitative study reinforced the finding that cost was a barrier to eye health. In each of the eight countries, some out of pocket payments were required for insurance premiums, to see particular providers and to access certain therapies. These costs impacted the availability of treatment for DR, particularly in middle- and low-income countries, where institutional resources are scarce and people with diabetes may be struggling just to meet basic needs. In some cases, providers reported that they offered services at a subsidised price to make treatments accessible to those who could not otherwise afford them.

In the quantitative study, sixty percent of providers (n=1141) reported that their patients wait less than one month for an appointment but 15% (n=282) reported a waiting time of more than two months. The waiting time varied considerably amongst the types of providers. Fifty-three percent of primary care providers (n=153) reported a waiting time of less than one week, compared with only 20% of ophthalmologists (n=150).

Inadequate referral processes were a strong theme in the interviews, with reports of some hospital ophthalmology departments not accepting referrals from diabetes specialists from the same hospital:

> *They must be sent from a family medicine clinic. So, for example, when I see a patient with diabetic retinopathy, I have to send them once again to see his family doctor, so he can be sent to the ophthalmologist from there.* (Diabetes specialist, Mexico)

The interviews also highlighted the difficulty of communication between disciplines as well as between the patient and health care professional. Some providers relied on their patients to convey medical information by specifically asking them to bring written reports from other medical specialists. Others more casually asked about care received, as illustrated by a primary care provider in Germany who sometimes had to ask the patient about the outcome of a visit to the eye specialist, from whom they often received no information.

> *"What can be a problem sometimes, depending on where we send them, like eye specialists, we get more or less feedback...there are standardised forms that [aren't] much trouble and that we get from a lot of eye specialist practices, but not always. Then you have to ask the patients themselves if he has been to the eye specialist and*

then the statement is not always very correct and reliable. This can be a problem then ... you don't exactly know if the patient has a problem or not." (Primary care provider, Germany)

The most substantial barrier reported by all health care professionals was the lack of knowledge and/or awareness of patients about diabetic eye complications (43%, n=732), followed by the lack of importance patients gave to eye examinations (33%, n=561), and the costs associated with care (32%, n=552). For primary care providers, long waiting times for scheduling an appointment was among the most commonly reported barriers (Table 4).

Table 4. Barriers reported by health care professionals to optimising eye health.

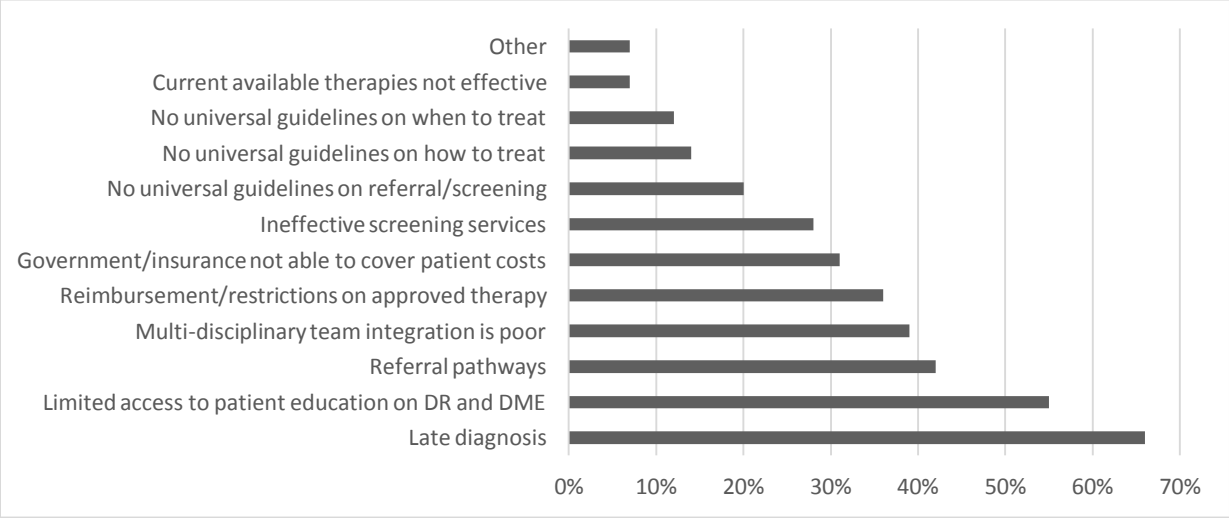
Barrier	All health care professionals	Primary Care Providers (N=365)	Diabetes Specialists (N=403)	Ophthalmologists (N=855)
Lack of knowledge and/or awareness	732 (42.9%)	99 (36.3%)	100 (33.0)	347 (51.2%)
Patients feel eye exams are not important	561 (32.9%)	79 (29.5%)	76 (25.1%)	243 (35.8%)
Cost of care	552 (32.3%)	73 (27.2%)	100 (33.0%)	255 (37.6%)
Long wait time for appointment	525 (30.8%)	117 (43.7%)	107 (35.3%)	186 (27.4%)
Patients feel eye complications are unlikely	510 (29.9%)	61 (22.8%)	70 (23.1%)	245 (36.1%)
Patients fear of treatment/results	467 (27.4%)	60 (22.4%)	77 (25.4%)	218 (32.2%)
Limited access to eye specialists	452 (26.5%)	102 (38.1%)	89 (29.4%)	148 (21.8%)
Referral process	446 (26.1%)	93 (34.7%)	64 (21.1%)	200 (29.5%)
Patients have competing responsibilities and priorities	389 (22.8%)	43 (16.0%)	61 (20.1%)	166 (24.5%)
Proximity to care	369 (21.6%)	58 (21.6%)	54 (17.8%)	167 (24.6%)
Limited access to diabetes specialists	332 (19.4%)	71 (26.5%)	31 (10.2%)	138 (20.4%)
Long wait time on the day of visit	272 (15.9%)	42 (15.7%)	53 (17.5%)	112 (16.5%)
Clinic too small or lack necessary equipment/staff	178 (10.4%)	37 (13.8%)	39 (12.9%)	56 (8.3%)

Patients they are a burden on family/friends	162 (9.5%)	24 (9.0%)	13 (4.3%)	79 (11.7%)
Recommended treatments are not available	148 (8.7%)	33 (12.3%)	31 (10.2%)	55 (8.1%)
Other	103 (6.0%)	16 (6.0%)	16 (5.3%)	31 (4.6%)
Total valid response	1,707 (100.0%)	268 (100.0%)	303 (100.0%)	678 (100.0%)
Total missing	622	97	100	177

NB [1]: The values [n=xx] show the maximum number of respondents in that group, but percentages are calculated from non-missing values for that group for the specific question

With respect to the ophthalmologists' views on the barriers to improving outcomes of patients with DED, 66% (n=373) mentioned late diagnosis; 55% (n=310) felt mentioned poor access to patient education on DR and 39% (n=220) mentioned poor multi-disciplinary team integration, referral pathways and reimbursement restrictions. Only 7% (n=38) of ophthalmologists reported that current therapies were not effective (Figure 2).

Figure 2. Barriers to improving patient outcomes with DED as reported by health care professionals



4. Discussion

The DR Barometer study captured for the first time the views and experiences of over 2,300 health care professionals from 41 countries involved in the management of adults with diabetes and subsequent eye health conditions, including DR and DME.

Findings from the DR Barometer study illustrate how by their own admission, primary care providers and diabetes specialists did not discuss eye care and the need for regular examinations with patients, with the regularity needed. Previous data already published from the study confirmed this observation from the viewpoint of people with diabetes, many of whom were unaware that diabetes could affect their eyes [14]. While almost all ophthalmologists routinely discussed eye health, only around a third discussed diabetes management in general, or blood pressure control in particular, even though this directly impacts progression of DR.

It is well established that many people have difficulty recalling the details of medical consultations [18]. Therefore, written information can be very useful in conveying important messages. Yet only a third of health care professionals surveyed had sufficient written information on DR available in their clinic.

It is therefore hardly surprising that providers reported a lack of awareness of DR amongst adults with diabetes as the most commonly reported barrier to optimising eye health and that nearly two-thirds of ophthalmologists reported that most patients presented when visual problems had already occurred and sometimes when it was already too late for effective treatment. Other major barriers included the high costs and waiting times for screening and treatment.

Health care professionals were also lacking in protocols to guide their own practice, with less than half having written protocols for the detection and management of diabetes-related vision issues. The lack of protocols may explain the variations in the factors that influenced ophthalmologists' treatment decisions, which included age, gender and educational level. Furthermore, the observation that more than one in five ophthalmologists reported that they had no formal training in the diagnosis or management of DR is a cause for concern.

Effective management of diabetes often requires people with diabetes to visit a number of specialists. Good communication, efficient referral practices, and a clear patient care pathway are essential to ensure that each professional has the appropriate patient information. However, this study suggests that suboptimal communication and referral practices between specialists were hindering effective care.

The rise in aging populations is likely to place excessive and unrelenting demands on the eye health and diabetes sectors in many countries, potentially leaving individuals with diabetes without timely access to screening and appropriate treatment that could help preserve their vision and function ability, and thereby their contribution to family and society. It is thus essential that all stakeholders involved in the management of adults with diabetes are in a position to implement practices to provide education on prevention, screen for and treat DED.

The most clinically and cost-effective response to the threat of DR is firstly to prevent diabetes from occurring [16], and secondly to prevent the onset of complications and its progression to a sight-threatening stage [17][18]. This is best achieved by preventing the onset of type 2 diabetes, supporting people with both type 1 and type 2 diabetes to keep their condition as well controlled as possible, and educating people with diabetes about the risks of DED and of the importance of regular eye screening.

Limitations

Although the study had a large sample size, it may not be representative of the broader population of these constituents. Different results might have been reached with a larger number of participants from low- and middle-income countries. The study population was self-selected and largely recruited through patient and civil society organisations and the practices of health care professionals, so participants were more likely to be interested in and engaged in the care of diabetes and DED than other providers. Consequently, their experiences may differ from a general sample of health professionals.

The consistency with which information was collected varied between respondents resulting in missing data and implausible responses to some questions. The variation in the consistency of the information collected may reflect different levels of understanding of the terminology and cultural differences in language used within the survey.

In most analyses, missing data were excluded with the underlying assumption that the observed data provided a reasonable representation of the study population and that the results would be consistent regardless of missing data. The reasons for missing data were unknown and therefore not clear as to whether bias was introduced into the analysis as a result. However, where bias does exist, the impact is likely to be greatest in analyses involving a small number of observations.

For some questions, respondents were able to select multiple answers. Whilst this provided broader insights from patients and providers, it also poses a challenge when interpreting the results as the total number of responses for some questions is greater than the total sample size.

Conclusion

In summary, in rising to the challenge of increasing prevalence of DR, Health care professionals need to be appropriately supported and trained so that they can work together to ensure that all adults with diabetes are well informed about the risks of DR, are supported in reducing their risk and have access to DR screening and appropriate treatment as required.

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Conflicts of interest

D Cavan, LE Makaroff, J da Rocha Fernandes, D Chaney, A Malhi, S Karuranga are current or former interns or employees of the International Diabetes Federation, which has received funding from AstraZeneca, Bayer AAG, BD, Boehringer Ingelheim, Lilly Diabetes, Medtronic, Merck Sharp and Dohme, Novartis, Novo Nordisk, Sanofi Diabetes, Servier, and Takeda. LE Makaroff has received honoraria for talks from Bayer AG. P Ackland and J Conlon are employees of the International Agency for the prevention of Blindness, which has received funding from Bayer AG. M Sylvanowicz is a current employee of Bayer AG.

Contributions

D Cavan, LE Makaroff, and J Barratt contributed to the study conception and design, data acquisition, data analysis, interpretation, drafting of the article, and critical revision.

D Chaney contributed to the study conception, design, data collection, and critical revision.

M Sylvanowicz contributed to the study conception, design, drafting of the article, and critical revision

P Ackland, and J Conlon contributed to the study conception and design, data collection, and critical revision.

J da Rocha Fernandes, A Mahli, and S Karuranga contributed to drafting the article and critical revision.

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