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Original Research

Perceptions of a Teleophthalmology Screening Program for Diabetic Retinopathy in Adults With Type 1 and Type 2 Diabetes in Urban Primary Care Settings

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Key Messages

- This qualitative study explored perceptions of implementing a teleophthalmology program in urban primary care settings.
- Patients were highly satisfied with the teleophthalmology program, but interest was lacking among providers.
- Methods to promote uptake include raising provider awareness of the program's value, streamlining administrative processes and centralising recruitment.

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ABSTRACT

Objectives: Teleophthalmology has improved diabetic retinopathy screening, and should be expanded in urban areas, where most unscreened individuals reside. In this study we explored facilitators and barriers of teleophthalmology in primary care settings in Toronto, Canada.
Methods: Semistructured interviews were conducted with 7 health-care providers and 7 individuals with diabetes to explore their perspectives of teleophthalmology in urban primary care settings. Interview data were analyzed using interpretive thematic analysis to generate themes.
Results: Six themes were identified. Facilitators included patient-centred implementation, access to teleophthalmology at primary care sites and patients' trust in their providers' recommendations. Barriers included patients' lack of understanding of diabetic retinopathy and the health-care system, providers' lack of interest and the need to streamline administrative processes.
Conclusions: Although teleophthalmology was well-received by patients, there was limited interest from primary care providers. Strategies for increasing uptake include increasing primary care providers' awareness of teleophthalmology's value in urban centres, improving administrative processes and centralizing patient recruitment.

Mots clés:
diabète
rétinopathie diabétique
dépistage de la rétinopathie diabétique
téléophtalmologie
dépistage télérétinien

RÉSUMÉ

Objectifs : La téléophtalmologie a contribué au meilleur dépistage de la rétinopathie et devrait s'étendre au milieu urbain où résident les individus non dépistés. Dans la présente étude, nous avons exploré les

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facilitateurs et les obstacles de la téléophtalmologie en milieu de soins primaires de Toronto, au Canada.
Méthodes : Nous avons réalisé des entretiens semi-structurés auprès de 7 prestataires de soins de santé et de 7 individus diabétiques pour explorer leurs points de vue sur la téléophtalmologie en milieu de soins primaires dans des centres urbains. Nous avons analysé les données d'entretiens à l'aide de l'analyse thématique interprétative pour générer les thèmes.
Résultats : Nous avons recensé 6 thèmes. Les facilitateurs étaient les suivants : la mise en œuvre axée sur le patient, l'accès à la téléophtalmologie dans des établissements de soins primaires et la confiance des patients à l'égard des recommandations de leurs prestataires. Les obstacles étaient les suivants : le manque de compréhension des patients en matière de rétinopathie diabétique et système de soins de santé, le manque d'intérêt des prestataires et la nécessité de simplifier les processus administratifs.
Conclusions : Bien que les patients aient accueilli favorablement la téléophtalmologie, les prestataires de soins primaires ont montré peu d'intérêt. Les stratégies visant à accroître son adoption portaient notamment sur l'intensification de la sensibilisation des prestataires de soins primaires à l'importance de la téléophtalmologie dans les centres en milieu urbain, l'amélioration des processus administratifs et la centralisation du recrutement des patients.

Introduction

Diabetic retinopathy (DR) is a potentially sight-threatening complication of diabetes, characterized by damaged blood vessels in the retina (1). Among working-age Canadians, diabetes is the number one cause of blindness (2). In Ontario, almost 1.4 million individuals are living with diabetes, with >50% living within the Greater Toronto area (GTA) (3). Best practice guidelines recommend annual DR screening for individuals with type 1 and 2 diabetes to prevent blindness (4). DR screening is typically performed by an ophthalmologist (5) or optometrist and involves pupil dilation, retina examination through indirect ophthalmoscopy and retinal fundus images. Despite these guidelines, DR screening rates are suboptimal in Ontario, with >400,000 residents overdue for screening (6). Major reasons for suboptimal adherence to screening guidelines include absence of symptoms, limited knowledge of DR and socioeconomic/geographic barriers to screening (7,8). In urban areas in Canada, low screening rates are found among those with low socioeconomic status, recent immigrants and younger age groups (9).

Teleophthalmology is a telemedicine-based screening program that uses digital imaging and communications technology to capture and send ocular images to an ophthalmologist for remote assessment (10). Previous research has demonstrated that teleophthalmology is cost-effective and improves access to timely DR screening (11,12). In systematic reviews, the majority of studies reported that teleophthalmology DR screening programs were comparable to traditional screening in terms of image quality, accuracy and reliability (13–15). Also, a number of studies cited high satisfaction or acceptability of teleophthalmology among patients and providers (10,11).

The Toronto Teleophthalmology Program (TTP) - an urban DR screening program based in primary care, has been successfully implemented in community health centres (i.e. organizations that deliver primary care and health promotion programs, especially to vulnerable populations), but is yet to be expanded to other primary care settings in Toronto. Offering teleophthalmology in a range of primary care practices is an important strategy for expansion, considering that the majority of patients with diabetes are seen in primary care settings and the TTP currently requires a referral from a primary care provider (PCP). Furthermore, few studies have addressed the utilization of teleophthalmology in urban Canadian settings, where the majority of unscreened people with diabetes reside (6,16). Therefore, in this study we explored the perspectives of patients with diabetes, PCPs and eye-care providers in Toronto with respect to facilitators and barriers of utilizing the TTP to gain insight into the feasibility of expanding the program across additional primary care practices in Toronto.

Methods

Study setting

In this study we focussed on the TTP, which was delivered in 2 regions within a large city (Toronto, Ontario, Canada). Through a referral from a physician, nurse practitioner or diabetes education centre, individuals with diabetes ≥18 years of age are eligible to receive DR screening through the TTP at no cost to the patient. Screenings are conducted by a trained registered practical nurse whereby medical/ocular history and images are taken, diabetes education is provided and health-care data are uploaded to a secure server. A retina specialist remotely evaluates images and health information and sends a digital report with treatment recommendations to the referring PCP, who is responsible for coordinating follow-up care, if required. Alternatively, support can be requested from the TTP to connect to ophthalmology or retina specialists.

Study design

In this qualitative study we used a semi-structured, emergent interview approach (17) to explore patients', PCPs' and eye-care providers' perspectives and/or experiences of the TTP. The study design and interview guide were developed based on guidance from an ophthalmologist, a family physician, a patient partner with diabetes and researchers with expertise in qualitative research. Initial interview questions focussed on gaining contextual information and exploring perceived barriers and facilitators of utilizing the TTP and ways to refine the service for end-users in primary care settings in urban centres. Contextual questions were asked to enable comparisons between in-person assessment by eye-care providers and the TTP and to understand perceived patient barriers to DR screening more generally in urban areas. In line with an emergent interview design, subsequent questions were based on participants' responses to initial questions to further explore their perspectives. With this shared focus, 3 separate interview guides were developed for the different participant groups to ensure relevance of questions (see Supplementary Appendixes A–C).

Recruitment and data collection

We used a purposive, snowball sampling recruitment approach in which we collaborated with staff members of the TTP focussed on DR screening to identify initial participants. Potential participants were approached in person, by phone and by e-mail. Existing study participants also recommended other potential participants

through word of mouth. Among the 11 providers and 8 patients who were contacted, 3 providers declined to participate, 1 provider was ineligible and 1 patient was unable to participate due to a language barrier. Fourteen participants in total, including 4 PCPs (1 nurse practitioner and 3 primary care physicians), 3 eye-care providers (1 retina specialist and 2 optometrists) and 7 patients with diabetes were interviewed. PCPs, a retina specialist and patients who had used the TTP at least once (n=12) were recruited to share their perspectives. Optometrists who had not used the TTP (n=2) were provided background information about the program and were recruited for their contextual expertise (i.e. providing eye care in an urban area).

Interviews were conducted over the phone (n=11) and at clinics after patients' teleophthalmology appointments through the TTP (n=3) and lasted up to approximately 50 minutes. All interviews were conducted individually with the exception of 1 patient interview (patient 03), wherein a family member consented to join and provide translation. Inclusion criteria for patients were being ≥18 years of age and diagnosed with type 1 or 2 diabetes, and having been provided access to the TTP. Inclusion criteria for primary and eye-care providers were experience providing care to patients with diabetes in the GTA and/or experience using the TTP.

Data analysis

Interviews were audio-recorded and transcribed verbatim. Interpretive thematic analysis (18) was initially conducted by the first author by coding the interview transcripts according to the research objectives. Coding was data-driven and involved an iterative process of reading the transcripts to identify common patterns or critical points across the data (18). Interview data and analyses were then discussed in depth with the second author and in multiple meetings with other research team members to refine themes.

Ethical considerations

The study received ethical approval from the Women's College Hospital Ethics Assessment Process for Quality Improvement Projects (REB No. 2019-0014-E). All participants provided either written or verbal consent before participating.

Results

Patients' perspectives of the TTP showed a high level of satisfaction, whereas interest among providers was modest. Facilitators of teleophthalmology included the TTP's patient-centred implementation, access to teleophthalmology at patients' primary care sites and patients' trust in their PCP's recommendation. Barriers included patients' lack of understanding of DR and how to navigate the health-care system, lack of interest among PCPs for teleophthalmology and providers' perception of the need to streamline the TTP's administrative processes.

Facilitators of teleophthalmology

Patient-centred implementation of teleophthalmology: Patients reported a high level of satisfaction with the TTP in terms of their experience. They valued the TTP providers' efforts to keep them informed throughout the screening process. Provider-to-patient communication opened a channel for patient education, which was an important means for promoting patients' understanding of DR, comfort and participation:

> I was happy with (the TTP provider). They informed me on everything that they were about to do, and then while they were doing it, I was talking with them and asking questions, so this satisfied my curiosity with that…I wasn't worried afterwards. (Patient 07)

The TTP providers' patient-centred care enabled a collaborative approach in which patients had the opportunity to express their needs and preferences. Participants' responses demonstrated that patient-centred approaches are crucial for fostering their willingness to participate in DR screening. As one patient explained:

> So, when I told the (TTP provider) I think I may need another (eye) drop, at least he understood me…which I appreciated because otherwise I would not have allowed anyone to, I mean, I would not have been able to stare at the light also. …The moment I told him my eyes are not numb, he put in another drop. So, these small things make you comfortable. They listen to the patient. (Patient 06)

Patients' trust in their PCP's recommendation: Patients' trust in their PCP's recommendation was a key facilitator influencing uptake of the TTP. The majority of patients in our study learned about the TTP through their PCP and chose to participate because they trusted their PCP's recommendation:

> When (a patient's) doctor tells them, "This is what you need to do," then they'll feel responsible enough that he has to more or less do this, because the doctor thinks that this is right. You have confidence in your doctor, don't you? (Patient 07)

Most patients felt that PCPs were in the best position to raise patient awareness about the TTP and DR screening in general, because they were often perceived as health knowledge brokers and patient advocates. In discussing ways to increase awareness about the TTP, one participant commented:

> The most important thing is the doctor, your family doctor. They have to tell you. They have to explain it to you. Then they have to remind you that it's very important to you because you are a diabetic. As a diabetic person, it's really hard because you don't know what's going on in you. (Patient 01)

Other methods for raising awareness about the TTP (e.g. posters, advertisements, etc) were identified, but some felt that this placed the onus on patients to research the program and would likely result in the need to consult with their providers anyway. Patients relied on their providers to help them navigate the health-care system and their recommendations were key to supporting the TTP's credibility and patient uptake.

Access to teleophthalmology at patients' primary care sites: The portability of the TTP made it possible for patients to receive DR screening at their primary care sites, which a number of patients strongly preferred over getting screened elsewhere. Some were even willing to travel further than a closer DR screening option to be seen at their primary care sites. Patients viewed these spaces as trusted settings that would support quality and continuity of care:

> It's better if I can keep everything within the diabetic health team. …Providing (teleophthalmology) is actually going to be a holistic coverage for my diabetic care. …By doing (teleophthalmology) through (the TTP), the access to my records is

much faster and direct, so I think that would be a much better thing to do. (Patient 04)

Similarly, some providers highlighted the value in enabling patients to receive screening in a familiar place because they felt that patients were often unaware of or uncomfortable accessing care outside of their regular PCP:

It could be that they're not sure of how to access other appointments. They might be comfortable coming to see their primary care provider at the community health centre but going to see specialists, that might be a challenge for various reasons. …Having to navigate outside of that comfort zone could be a barrier. (HCP 01, nurse practitioner)

One provider noted that offering teleophthalmology at primary care sites would enable the opportunity for PCPs to connect patients directly with the teleophthalmology provider to further support continuity of care and engagement with DR screening:

For example, if I'm making a referral to a counsellor, it's so much easier if they're on site. I can introduce the person to the counsellor, and then there's something there to tie them so they're more likely to make the appointment. …If I just say, you should book with a counselor…a lot of people will walk to the front and not make the appointment, and then walk out. …That would be the advantage of having (teleophthalmology) on site. (HCP 07, primary care physician)

Barriers to teleophthalmology

Patients' lack of understanding of DR and how to navigate the health-care system: Although all patients in this study recognized the importance of DR screening, the majority lacked knowledge of the health-care system. Patients' narratives often conveyed confusion over the procedures and personnel involved in DR screening. Participants shared a common notion that patients' misconceptions about the health-care system were a barrier to accessing the TTP. For instance, one patient commented that new immigrants in particular may be hesitant to access care, including teleophthalmology, due to misconceptions about out-of-pocket costs:

When (new immigrants) come here, they think they have to take a risk when going to check with the doctors and all that. To pay for all the things. So they stay away, "Oh, I'm not going to go there," because they don't have money to pay for all of these expenses. (Patient 02)

Similarly, a provider discussed patients' lack of understanding of different eye examinations and costs as barriers to participation in the TTP:

They don't understand the difference between an optometrist and an ophthalmologist, and they don't understand it's a (tele-ophthalmology) screening program. They don't have to pay to have their pictures taken. (HCP 04, retina specialist)

Providers also felt that patients are often unaware of the need to receive annual DR screening and the severity of the disease due to its lack of symptoms. As one provider commented: "It could be health literacy that is a barrier that they maybe are not understanding why it's a priority because they don't feel that their vision is a concern at this time" (HCP 01, nurse practitioner).

Lack of interest among providers for teleophthalmology: Some providers believed that teleophthalmology could benefit patients who face barriers to accessing care outside their regular primary care site; however, their interest was diluted by the perception that teleophthalmology does not address key challenges to screening in urban centres. They felt that the TTP would be more valuable in areas with limited access to DR screening, such as rural communities. Providers' lack of interest seemed to reduce their motivation to make referrals:

I think the whole idea of teleophthalmology is in giving patients a certain type of access that they wouldn't normally have. We did not find that there was too much of a problem getting access for my patients in the first place, given the fact that a lot of who we refer are diabetic patients and they're there for, sort of, an annual or biannual eye examination, which there's time to organize months ahead of time. So the time stature and the convenience doesn't factor in as much. (HCP 05, primary care physician)

Providers commented on a multitude of factors underlying low screening rates in the GTA, including the challenge of connecting with unscreened patients who have fallen through "cracks" in the health-care system (e.g. due to competing priorities, fear, low health literacy, etc). Some providers felt that teleophthalmology is not designed to address the root of the issue - the need to identify and recall unscreened patients in urban centres. This perspective acted as a barrier to uptake. As one provider explained:

…the number of people who are not getting (DR screening) because they physically can't get to a place, like in a place like Toronto, where there's a lot of optometrists and ophthalmologists, they're not having their eye exam probably not because they can't get somewhere…we do have physical access (in the GTA), we also have less than 100% uptake, and that's a problem. But I don't know that teleophthalmology actually solves the problem.

This provider endorsed a centralised approach to patient recruitment for DR screening, citing a need to "(look) through the database, (look) through people who haven't had an eye exam in the last year, and who have a diagnosis of diabetes. You don't need the TTP to do that" (HCP 07, primary care physician).

Providers' perception of the need to streamline teleophthalmology administrative processes: Many providers in our study perceived a need to streamline the administrative process of the TTP with respect to the procedure for referrals, saving and sending reports and retrieving patient information for follow-up/billing purposes. From the PCPs' perspectives, the referral process imposed increased burden, adding an additional step, which they felt was unnecessary or avoidable:

I don't mind referring (to the TTP) if everything gets looked after, but there was a period of time at least that so many of the referrals coming back would say that the patient should see a real-life ophthalmologist. …I'm wondering, why am I referring to your program in the first place? I just need to refer to an ophthalmologist and then everything gets looked after. It becomes actually more work for me to refer to your program. (HCP 05, primary care physician)

A retina specialist who uses the TTP commented on the potential issue of losing patients to follow up in the absence of a more streamlined administrative process:

> There are limitations within the way it saves, sends reports, that makes us, as reviewers, a little bit unable to know the process. What I mean is, I can't go back and make sure, at least I don't know personally how to do it, that a report that I wrote was actually sent back and received by the referring person. …Because there's an issue also with liability which is, let's say there is something significant that needs assessment or treatment and then that doesn't happen, are we liable as screeners? Or is the referring person liable if they get that report and don't refer them? So, there should be some kind of safety net in place where the screened patients that have issues don't fall through the cracks. (HCP 04, retina specialist)

Their concern suggests the need to clearly communicate the approach to follow up, including the responsibilities of the different providers involved and tracking mechanisms to ensure accountability and coordination.

Discussion

This study of patient and provider perceptions of an urban teleophthalmology DR screening program revealed a disconnect between patient and provider perspectives. Our findings suggest that teleophthalmology was well-received by patients; they favoured the ability to be screened at their regular primary care sites and trusted their PCP's recommendation. Although providers cited benefits of the TTP, interest was lacking because they did not perceive that teleophthalmology addressed key barriers to screening in urban centres. PCPs highlighted the need to comprehensively identify and reach out directly to patients behind on screening - a mechanism that is outside the scope of the TTP. Furthermore, providers' perceptions of the need to better streamline the TTP's administrative processes also impeded uptake.

The TTP's commitment to ensuring provider-to-patient education and communication was important for facilitating patient uptake as they valued feeling informed and involved in the care process. This could influence beliefs about the value of DR screening among patients with diabetes (19). Health education on DR influences patients' decision to engage in DR screening (7) and fosters participation in their care (20). Echoing former research (10,21), our study has shown that PCPs play an important role in facilitating patients' awareness of DR, and in promoting participation in DR screening. Similarly, patients with diabetes are more likely to participate in regular eye examinations when they trust their provider and receive ongoing care (22,23).

A number of studies in rural areas cited convenience as a strong facilitator of patient participation in teleophthalmology DR screening (10,24). In our study, patients' strong preference to access teleophthalmology through their regular primary care sites was mainly associated with factors related to continuity of care rather than travel distance. Offering teleophthalmology at patients' primary care sites makes point-of-care DR screening (i.e. screening that occurs at or proximal to the site/time of patient care) possible (20,21). This could help reconcile some factors that participants perceived to contribute to low DR screening rates in urban areas. PCPs identified fragmented care as a reason for losing patients to follow up when screening is shifted further away from the point of care. Providers' views corroborate previous research (25,26), which indicated that offering teleophthalmology at primary care sites could help improve continuity of care between primary and specialized health services for people with diabetes. In line with other research (27), the capacity for teleophthalmology to make point-of-care DR screening possible is significant as it supports earlier detection and treatment, which is critical for preventing vision loss.

Teleophthalmology has demonstrated effectiveness (28,29) and was well accepted by patients in our study, as in other studies (24,30); providers' indifferent responses to the TTP in our study reveal the need to better communicate its value to providers and reduce provider burden. Although the TTP was well-accepted by patients, our findings suggest that a major factor influencing teleophthalmology uptake among providers is their perception of the fit between the TTP's offerings and perceived challenges to DR screening. Barriers to screening in urban centres were acknowledged by providers in our study; however, some felt that teleophthalmology only addressed a subset of barriers contributing to low screening rates. These barriers exist among a multitude of others identified in previous research (8). Because providers largely identified teleophthalmology as a means to address geographic and temporal access specifically, they did not see the need for it in urban centres, where these issues were not considered a significant challenge. However, previous research has demonstrated that geographic and timely access to DR screening is an issue in urban settings due to limitations in health system capacity, patient knowledge and language and financial barriers, particularly in places where patients are uninsured/underinsured (16,31,32). Providers' contrasting perceptions highlight the need to deepen their knowledge of patient barriers to DR screening access.

PCP education could increase providers' understanding of the lack of access to DR screening in urban centres and improve awareness of teleophthalmology's ability to address this issue.

Adjustments to the TTP have been made but could be better communicated to reduce perceived workload and support uptake. Additional adjustments could include creating workflow integrated referral/follow-up processes, improving communication between those involved in referral and review, the Ministry of Health enabling patients to attend the TTP without a PCP referral and the ability of the TTP to directly refer patients to specialty care if needed. Building on provider suggestions regarding key barriers, Canadian urban settings could implement the TTP outside of primary care using a population-based approach to screening similar to the one in the United Kingdom (33), which used administrative health data to identify unscreened patients and mailed letters to invite them for screening at convenient locations. They found that >82% were screened among over 2.5 million who were contacted. Other centralised approaches (organized screening programs) have demonstrated greater effectiveness in increasing screening in other patient populations than opportunistic screening through primary care clinics (34,35). This finding, along with PCPs' modest interest in teleophthalmology in our study, suggest the need to explore ways to expand the TTP through additional methods that are not solely PCP driven in urban areas.

In conclusion, our results demonstrate that patients were highly satisfied with the TTP, but there was a lack of interest among providers in urban centres. Continuity of care and PCPs' recommendations represented the most critical facilitators of patient participation. However, the crucial role that PCPs play in facilitating engagement is at odds with their lack of interest in the TTP due to perceptions of low demand in urban regions. To facilitate the expansion of teleophthalmology across primary care settings in Toronto, it is important to increase providers' awareness of low DR screening rates and the value propositions of teleophthalmology, streamline the TTP's administrative processes and consider a population-based approach using administrative health data to aid in the recruitment of patients for DR screening.

Supplementary Material

To access the supplementary material accompanying this article, visit the online version of the *Canadian Journal of Diabetes* at www.canadianjournalofdiabetes.com.

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Author Disclosures

M.B., O.S. and R.M. created and coordinated implementation of the Toronto Teleophthalmology Program.

Author Contributions

M.N. collected, analyzed and interpreted the data, and drafted the manuscript. O.B., M.B. and V.S. led in the conception of the study design, contributed to data analysis and revised the manuscript. V.S. also contributed to data collection. R.S.B. oversaw coordination of the study and revised the manuscript. N.O., R.M., O.S. and I.W. participated in coordination of the study and revised the manuscript. K.M. participated in the conception of the study design, coordination of the study, data collection and manuscript revision. L.I.B. participated in study design and revised the manuscript. All authors read and approved the final manuscript submitted for publication.

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