

Expanding Access to Diabetic Retinopathy and Depression Screening



Telemedicine can help during the COVID pandemic.

BY RAJIKA JINDANI, MS; JACLYN PERREAULT, BA; RAQUEL GOLDHARDT, MD, FACS; JORGE CUADROS, OD, PHD; AND DELIA CABRERA DEBUC, PHD

A significant association has been identified between diabetic retinopathy (DR) and depression, two common comorbidities of diabetes. Both conditions greatly affect quality of life and management of this chronic systemic disease.¹

Individuals with diabetes in low-resource settings have historically faced barriers to care, and these have been further aggravated by the COVID-19 pandemic, causing greater disruption to their eye care and mental health care. The increased use of technology to reach these populations could provide a solution to this health care gap.

The role of telemedicine in providing DR screening has been validated, but fewer than 50% of individuals with diabetes receive annual DR screening examinations.^{2,3} This article presents one way in which telemedicine can play a role in screening for both DR and depression, potentially improving diabetes care in low-resource settings.

COMMON COMORBIDITIES

The prevalence of depression in individuals with DR ranges from 35.7% to 50%.^{1,4} Studies have found that patients with any level of DR are more likely to experience depression compared with other diabetic patients.^{5,6} Conversely,

patients with diabetes with higher scores on depression screening have an increased risk for DR.^{7,8}

DR and depression are each associated with socioeconomic risk factors that increase the likelihood of developing the other condition. DR and depression may also be biologically linked through mechanisms including circulating inflammatory cytokines, insulin deficiency,

AT A GLANCE

- ▶ DR and depression are common comorbidities of diabetes.
- ▶ DR and depression are each associated with socioeconomic risk factors that increase the likelihood of developing the other condition.
- ▶ A pilot program assessed the ability of a telemedicine-based screening model to detect DR and depression in a low-resource setting.

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chronic hypo- or hyperglycemia, hypothalamus-pituitary-adrenal axis hyperactivity, and others.¹

SCREENING TOOLS AND IMAGE TRANSMISSION

With the emergence of COVID-19, the use of telemedicine has become not only more widespread in general but also crucial for reaching patients in areas of limited access.^{9,10} Telemedicine is valuable for its ability to reduce the number of in-person appointments for diabetic patients, who are at high risk for complications of COVID-19.¹¹

The use of telemedicine allows clinic staff to conduct DR screening during a general primary care appointment, which can help to reduce the number of in-person appointments without sacrificing important assessments.

Depression screening using a validated questionnaire, such as the Patient Health Questionnaire (PHQ), can also be conducted during primary care appointments to identify patients who may require urgent referral to a psychiatrist. As social isolation and symptoms of depression may intensify during pandemic situations, depression screening for at-risk diabetic patients should be included during telemedicine or in-person appointments.

PILOT PROGRAM

Students from the University of Miami Miller School of Medicine initiated a pilot screening program for DR as a part of their MPH Capstone project at a secondary care outpatient center in Juiz de Fora, Brazil. Fifty patients with established type 1 or 2 diabetes were screened at the clinic by these students in collaboration with faculty and students from

Universidade Federal de Juiz de Fora.

A telemedicine and artificial intelligence (AI)-based model was used to identify DR. Images were captured by a Fundus on Phone (FOP; Remidio) portable camera donated by the retina screening service EyePACS.¹² The fundus camera uploaded the retinal images onto the online EyePACS platform, which used an AI algorithm to identify referable cases (ie, DR/no DR) to an ophthalmologist within minutes without having to dilate the patient's eyes.

Ophthalmologists from the EyePACS system reviewed the images and provided final recommendations. Cases identified as referable through AI interpretation of retinal images were expedited for urgent evaluation by an ophthalmologist. A validated questionnaire for depression screening was also administered at the time of the primary care visit.

Preliminary results showed that, among the 50 patients screened, 22 (44%) were identified with signs of DR, and, of these, 13 (26%) required urgent referral to an ophthalmologist. All 50 patients were counseled on signs and symptoms of DR as well as preventive measures. One patient was scheduled for urgent surgery following the screening.

Among those who completed the depression screening questionnaire including the PHQ-2, 13 individuals (26%) had scores indicating a high risk of depression. Of the 13 individuals who had positive PHQ-2 results, eight were also identified as having signs of DR.

ULTIMATE VISION

We encourage providers in low-resource settings to implement telemedicine-based screening for DR and

depression into their routine appointments for patients with diabetes mellitus. Our pilot program in Juiz de Fora, Brazil, demonstrated the feasibility of a medical student-run model to implement these screening measures during patients' primary care appointments, leading to expedited specialist referrals for high-risk individuals. The preliminary results demonstrated a need for retinopathy and depression screening in this patient population.

Benefits of this program can include improved outreach to patients in low-resource settings or rural locations lacking access to specialists, as well as potential improvement in compliance. Combining DR and depression screening with a routine care appointment decreases barriers to care by reducing the number of days patients take off from work, the money lost in wages, and expenditures for travel to appointments.^{13,14}

It is anticipated that findings may be similar in other low-resource settings in which appointments with specialists are not readily accessible. In addition, this model may prove useful in reducing the number of in-person visits for patients with diabetes mellitus during the COVID-19 pandemic without sacrificing important comorbidity screening and may allow users to provide further assistance through an internet-based mental health program. ■

1. Chen X, Lu L. Depression in diabetic retinopathy: a review and recommendation for psychiatric management. *Psychosomatics*. 2016;57(5):465-471.

2. Mansberger SL, Shepler C, Barker G, et al. Long-term comparative effectiveness of telemedicine in providing diabetic retinopathy screening examinations: a randomized clinical trial. *JAMA Ophthalmol*. 2015;133(5):518-525.

3. Shi Q, Zhao Y, Fonseca V, Krousel-Wood M, Shi L. Racial disparity of eye examinations among the U.S. working-age population with diabetes: 2002-2009. *Diabetes Care*. 2014;37(5):1321-1328.

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4. Briganti CP, Silva MT, Almeida JV, Bergamaschi CC. Association between diabetes mellitus and depressive symptoms in the Brazilian population. *Rev Saude Publica*. 2018;53:05.
5. Poongothai S, Anjana RM, Pradeepa R, et al. Association of depression with complications of type 2 diabetes—the Chennai Urban Rural Epidemiology Study (CURES- 102). *J Assoc Physicians India*. 2011;59:644–648.
6. Sharif S, Raza MT, Mushtaq S, Afreen B, Hashmi BA, Ali MH. Frequency of depression in patients with type 2 diabetes mellitus and its relationship with glycemic control and diabetic microvascular complications. *Cureus*. 2019;11(7):e5145.
7. Ishizawa K, Babazono T, Horiba Y, et al. The relationship between depressive symptoms and diabetic complications in elderly patients with diabetes: analysis using the Diabetes Study from the Center of Tokyo Women's Medical University (DIACET). *J Diabetes Complications*. 2016;30(4):597–602.
8. Sieu N, Katon W, Lin EH, Russo J, Ludman E, Ciechanowski P. Depression and incident diabetic retinopathy: a prospective cohort study. *Gen Hosp Psychiatry*. 2011;33(5):429–435.
9. DeBuc DC. The role of retinal imaging and portable screening devices in tele-ophthalmology applications for diabetic retinopathy management. *Curr Diab Rep*. 2016;16(12):132.
10. Li HK, Horton M, Bursell SE, et al. Telehealth practice recommendations for diabetic retinopathy, second edition. *Telemed J E Health*. 2011;17(10):814–837.
11. Muniyappa R, Gubbi S. COVID-19 pandemic, coronaviruses, and diabetes mellitus. *Am J Physiol Endocrinol Metab*. 2020;318(5):E736–E741.
12. Bhaskaranand M, Ramachandra C, Bhat S, et al. The value of automated diabetic retinopathy screening with the EyeArt system: a study of more than 100,000 consecutive encounters from people with diabetes. *Diabetes Technol Ther*. 2019;21(11):635–643.
13. Avidor D, Loewenstein A, Waisbourd M, Nutman A. Cost-effectiveness of diabetic retinopathy screening programs using telemedicine: a systematic review. *Cost Eff Resour Alloc*. 2020;18:16.
14. Pasquel FJ, Hendrick AM, Ryan M, Cason E, Ali MK, Narayan KM. Cost-effectiveness of different diabetic retinopathy screening modalities. *J Diabetes Sci Technol*. 2015;10(2):301–307.

JORGE CUADROS, OD, PHD

- Director of Clinical Informatics Research and Assistant Clinical Professor, UC Berkeley School of Optometry, Berkeley, California
- jcuadros@berkeley.edu
- Financial disclosure: CEO (EyePACS)

DELIA CABRERA DEBUC, PHD

- Research Associate Professor, Bascom Palmer Eye Institute, Miami
- dcabrera2@med.miami.edu
- Financial disclosure: None

RAQUEL GOLDBART, MD, FACS

- Associate Professor of Clinical Ophthalmology, Bascom Palmer Eye Institute, Miami
- rgoldhardt@med.miami.edu
- Financial disclosure: None

RAJKA JINDANI, MS

- MD/MPH Candidate, University of Miami Miller School of Medicine, Miami
- rxj277@med.miami.edu
- Financial disclosure: None

JACLYN PERREAULT, BA

- MD/MPH Candidate, University of Miami Miller School of Medicine, Miami
- jcp208@med.miami.edu
- Financial disclosure: None